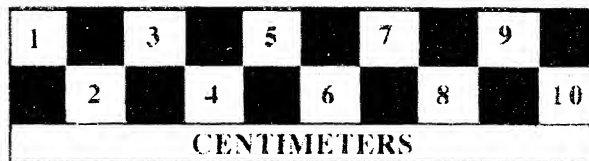


AN ARCHAEOLOGICAL INVESTIGATION OF ARTIFACTS  
AND HUMAN REMAINS FROM CA-CCO-637,  
LOS VAQUEROS PROJECT AREA,  
CONTRA COSTA COUNTY, CALIFORNIA



*prepared by*

Jack Meyer, M.A.  
Jeffrey S. Rosenthal, M.A.

1998

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May 1998

## DEDICATED IN HONOR OF HAROLD BURRIS

When Esther Burris and her family attended the Los Vaqueros Reservoir dedication ceremony on May 2, 1998, we learned that her husband, Harold Burris, had passed away. Harold was a father, grandfather, and an important member of the Ione Miwok. His interest in the Los Vaqueros area was demonstrated through his ongoing involvement in the project.

Harold had a unique ability to connect the past with the present. After visiting the Vasco Caves at Los Vaqueros a few years ago, Harold had a vision of a person pounding acorns in a cave which he sketched (below). His drawing invites one to come in, sit down, and experience daily life as a member of the family. Thanks for sharing some your time and energy with us Harold -- we will miss your company.



*I like to hear a coyote at night.*

*I used to listen to them.*

*They sound like a dozen coyotes when one of them is howling.*

*Can you imagine sitting in front of one of those caves,  
sitting and listening to the coyotes singing?*

*Harold Burris*



## ABSTRACT

This investigation primarily reports the results of archaeological monitoring conducted between September 1996 and October 1997, during the excavation of the stilling basin drainage pipe trench, the transfer pipeline trench, the spillway outlet channel, and two drainage ditches. Archaeological materials recovered at the site before September 1996 were analyzed and reported separately by Meyer and Rosenthal (1997). The remains of at least seven prehistoric Native Americans were identified during this monitoring phase, as well as a variety of flaked-stone and ground-stone artifacts.

Archaeological investigations at CCO-637 have revealed a surprisingly long and complex record of human occupation that spans more than 8,500 years. The radiocarbon date (8530 B.P.) from Burial 21 confirms the presence of a Lower Archaic period component at the site, and is the earliest date associated with human remains reported in the San Francisco Bay-Delta region. This Lower Archaic component is the second such component identified in the upper Kellogg Creek drainage near the Los Vaqueros dam (the other was found at site CCO-696), and distinguishes CCO-637 as one of the few early Holocene-age archaeological sites identified in the region.

Four radiocarbon dates from the site demonstrate that a significant Middle Archaic component is also represented. These include one of the oldest dated shell-bead lots (4770 B.P.) in central California. The varied assemblage of artifacts, features, faunal and plant remains, and 23 human burials associated with this component suggest that the site was at least used as a semi-permanent residential base. These findings provide the most compelling and complete evidence for Middle Archaic human occupation yet identified in the Los Vaqueros area. In addition, obsidian hydration readings indicate that the site continued to be used (at least sporadically) by people during the Upper Archaic and Emergent periods.

Despite extensive earth-moving and construction, portions of CCO-637 remain relatively undisturbed and may yet contain significant deposits of archaeological materials, including human remains. For this reason, the site appears to have the potential to yield information that is very important for understanding little known periods of California prehistory. Due to the probability that archaeological research potential of the site has not been exhausted, recommendations are provided for the future protection, research, and treatment of the site.



## ACKNOWLEDGMENTS

Contra Costa Water District (CCWD) funded the archaeological investigations reported here as mitigation of impacts associated with the Los Vaqueros Project. CCWD is credited for understanding the importance of sponsoring these studies and for coordinating the Native American involvement. We would like to acknowledge CCWD personnel, Gary Darling, Betty Graham, and Janice Hutton, for the expertise, support, and cooperation. Special thanks go to all of the Native American monitors who assisted us in the field, and to Andrew Galvan (Ohlone) and Harold Burris (Miwok) for their participation as Most Likely Descendants.

Several government agencies are participants in the cultural resources Programmatic Agreement for the Los Vaqueros Project. We would like to acknowledge their representatives, who have reviewed the project's archaeological reports and offered helpful comments: G. James West, Bureau of Reclamation; Patti Jo Johnson, U.S. Army Corps of Engineers; and Donna Sheeders, California State Water Resources Control Board.

Many individuals played a crucial part in the field investigations. Greg White recognized the archaeological potential of the area and was instrumental in formulating the field work plan and research strategy. Heartfelt thanks goes to all the members of the field crew, particularly Chris Lowgren and John Sharp, who assisted us during many days of archaeological excavation, monitoring, and burial removal. The subsurface survey at the site was accomplished with the help of "Backhoe" Bruce Harborth. We would also like to thank the many workers and heavy-equipment operators of Keiwi Construction for their understanding, patience, and assistance in the field.

Julie Huddleson and Seanna Gause brought order to the lab and the site catalog despite numerous changes. Thousands of beads were carefully measured and entered into a database by Barbra Polansky. Dr. Lori Hager performed a thorough analysis of the human remains despite their often fragmentary nature. Eric Wohlgemuth went the extra mile to examine and evaluate the archaeobotanical remains from an additional feature discovered during construction at the site.

Many of us felt particularly fortunate to have worked with Dr. David Fredrickson during this project, for it was his foresight, patience, and determination that guided this project throughout. Now, more than 15 years after it began, we know that others who worked with you on this project join us in saying -- thank you Dave!

Jack Meyer

Jeffrey S. Rosenthal

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# **AN ARCHAEOLOGICAL INVESTIGATION OF ARTIFACTS AND HUMAN REMAINS FROM CA-CCO-637, LOS VAQUEROS PROJECT AREA, CONTRA COSTA COUNTY, CALIFORNIA**

## **INTRODUCTION**

An archaeological investigation of artifacts and human remains identified during the final phases of archaeological monitoring at CA-CCO-637 was requested by Janice Hutton of the Contra Costa Water District (CCWD). The investigation was conducted to meet regulatory requirements for the consideration of cultural resources as part of the Los Vaqueros Project -- a Federal undertaking. The purposes of the investigation were: (1) to identify the age, nature, and extent of newly discovered archaeological materials from the site; (2) to integrate the new data with previous archaeological data from the site; (3) to integrate and synthesize new findings with previous findings from the Los Vaqueros Project area; and (4) to make recommendations regarding future research and possible treatment of the site.

This investigation reports the results of monitoring conducted between September 1996 and October 1997, during the excavation of the stilling basin drainage pipe trench, the transfer pipeline trench, the spillway outlet channel, and two drainage ditches. Archaeological materials recovered at the site before September 1996 were analyzed and reported separately by Meyer and Rosenthal (1997). The remains of at least seven prehistoric Native Americans were identified during this monitoring phase, as well as a variety of flaked-stone and ground-stone artifacts. A radiocarbon date obtained from one of the burials confidently places people at the site more than 8,500 years ago. The antiquity of this site distinguishes it as one of the few early Holocene-age archaeological sites identified in the region.

Despite extensive earth-moving and construction, portions of CCO-637 remain relatively undisturbed and may yet contain significant deposits of archaeological materials, including human remains. For this reason, the site appears to have the potential to yield information that is very important for understanding little known periods of California prehistory. Due to the probability that archaeological research potential of the site has not been exhausted, recommendations are provided for future research and treatment of the site (see Recommendations section).

## **PROGRAMMATIC AGREEMENT AND HPTPs**

Pursuant to Section 800.13 of the regulations (36 CFR 800) implementing Section 106 of the National Historic Preservation Act, the U.S. Bureau of Reclamation (Reclamation), CCWD, the U.S. Army Corps of Engineers, the California State Water Resources Control Board, the State of California Historic Preservation Office, and the Advisory Council on Historic Preservation entered into a Programmatic Agreement stipulating Reclamation's Section 106 responsibilities as the lead agency. Since some cultural resources will not be potentially affected for many years, a phased treatment program is being implemented to facilitate project development while avoiding or minimizing effects on historic properties within the Project Area of Potential Effects (APE). The treatment program is guided by Historic Property Treatment Plans (HPTPs), three of which have been developed to date (Sonoma State University Academic Foundation [SSUAF] 1993, 1994, 1995). The first two HPTPs deal with the treatment of recorded NRHP-eligible properties that would be affected by (1) the first phase of construction within the Los Vaqueros Project: the relocation of Vasco Road, the relocation of utilities, and the construction of water-conveyance facilities; and (2) the construction of the dam and reservoir. The third HPTP, covers sites encountered in the project APE that were not identified in the inventory or evaluation phases. While the initial phases of investigation at CA-CCO-637 were treated under the *Historic Property Treatment Plan for the Construction of the Reservoir and Dam, Los Vaqueros Project, Alameda and Contra Costa Counties, California* (SSUAF 1994), the current investigation was treated under the *Historic Property Treatment Plan for Late Discoveries, Los Vaqueros Project, Alameda and Contra Costa Counties, California* (SSUAF 1995).

## ANTICIPATED LATE DISCOVERIES

The Late Discoveries HPTP details the steps to be taken if an unknown archaeological deposit is encountered during construction. With this plan in place, the agency official is not required to consult with the Advisory Council upon each new discovery. Instead, the requirements of Section 106 are satisfied by simply following the plan. As part of the Late Discoveries HPTP, CCWD entered into a contract with the Sonoma State University Academic Foundation to undertake the evaluation and treatment of such finds as part of construction support services. The investigation of prehistoric archaeological site CA-CCO-696, for instance, was treated under the Late Discoveries HPTP (Meyer and Rosenthal 1997). The following excerpts are taken from the HPTP:

Despite the rigorous and multifaceted approach to identifying historic properties located within the Los Vaqueros Project APE, there is the possibility that undiscovered archaeological resources will be encountered during construction. Efforts have been made to identify buried deposits wherever surface or unearthened indicators have been found. The cost involved in subsurface investigation of all likely locations, however, cannot be justified. Thus there is a moderate to high potential for encountering one or more buried archaeological deposits during construction [SSUAF 1995:6].

The regulations also provide for the evaluation of the NRHP eligibility of such Late Discoveries by stating, "When a newly discovered property has not been previously included in or determined eligible for the National Register, the Agency Official may assume the property to be eligible for purposes of Section 106" (Section 800.11[d] [1]) [SSUAF 1995:2].

## THE NATURE OF THE PROJECT

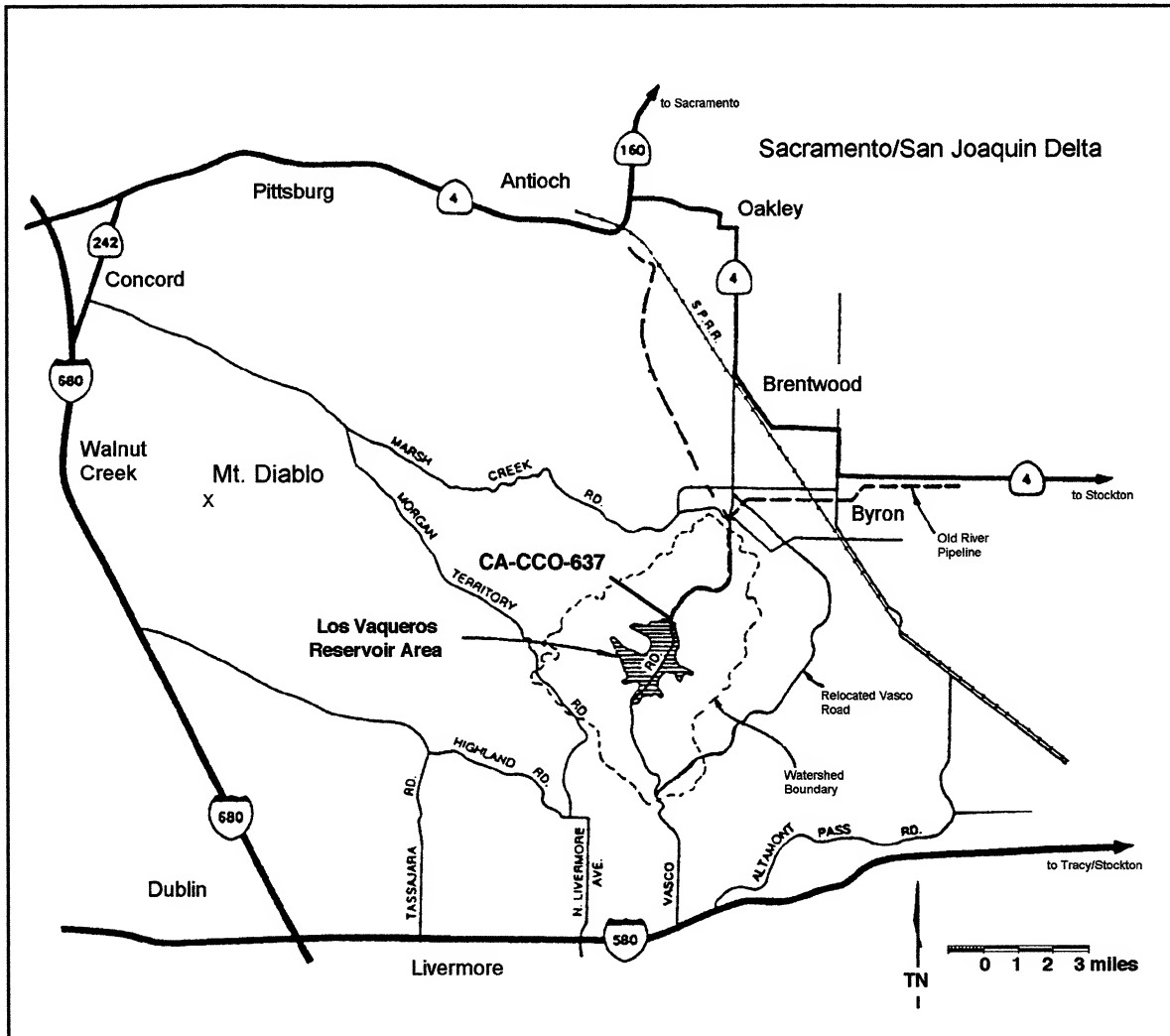
The Los Vaqueros Project includes the construction of water-intake and conveyance systems and a large earthen-dam and reservoir that will inundate part of the valley of the upper Kellogg Creek drainage. The project is designed to seasonally pump fresh water from the Old River in the Sacramento-San Joaquin Delta through a system of pipelines to the reservoir for temporary storage. Water stored in the reservoir will then be transferred to the Contra Costa Canal and used for blending with saltier water to improve water quality and to supplement seasonal shortfalls within Contra Costa Water District.

An overflow spillway, located northwest of the dam, is designed to control the low probability that water levels may exceed an elevation of 472 feet above mean sea level (AMSL). Water entering the spillway would drop more than 180 feet through an open concrete-canal until it reaches a concrete stilling basin near the valley floor. As water exits the stilling basin, it would first pass through an open rock-lined canal and then through an open earth and grass-lined canal before entering the Kellogg Creek channel. Runoff from the spillway area would flow through open rock- and grass-lined ditches that either drain into the spillway outlet canal or the Kellogg Creek channel.

## PROJECT AREA LOCATION AND DESCRIPTION

The Los Vaqueros Project area is located approximately 40 miles east of San Francisco and 25 miles west of Stockton, in eastern Contra Costa County, California. Communities located within 10 miles of the study area include Livermore to the south and Byron and Brentwood to the northeast (Map 1). Much of the project area lies within the unsectioned *Canada de los Vaqueros* land grant as depicted on the USGS Byron Hot Springs California, 7.5' series topographic quadrangle (1953, photorevised 1968).

The climate of this area is Mediterranean, characterized by mild, wet winters and hot, dry summers. Temperatures can range from about 15 to 115 degrees (-9 to 46 degrees Celsius), with a mean annual average of about 60 degrees (15.5 degrees Celsius). The semi-arid climate of the area is due to its location within the rain shadow Mt. Diablo, which lies about 13 miles to the west. The primary water source is the Kellogg Creek channel and associated tributaries. The vegetation included many large oak trees, with cottonwood and willow trees concentrated along the creek channels. The floor of the valley was dominated by annual forb and grass species, with a few widely spaced large oaks.



**FIGURE 1. Location of the Project Area**

The landscape of the project area consists of a series of rounded hills and narrow valleys, typical of the foothill regions found in the northern Diablo Ranges. Hillslopes in the reservoir area reach elevations of about 300 m (approximately 1,000 ft.) AMSL, and are underlain by late Cretaceous-age marine shale, siltstone, and sandstone of the Panoche formation (Dibblee 1980). The intervening valleys contain nearly level alluvial floodplains and gently sloping alluvial fan deposits that coalesce around the valley margins. Many of the floodplains are incised as much as 2 to 3 m (6 to 10 ft.) by the channels of seasonal and/or perennial streams.

Geoarchaeological studies (Meyer and Rosenthal 1997) in the reservoir area have shown that older alluvial-fan deposits are generally found along the margins of the valley, while younger floodplain deposits are generally found near the center of the valley. Stratigraphic evidence and

radiocarbon dates indicate that: (1) the alluvial fans are generally late Pleistocene to early Holocene in age; (2) the floodplain deposits are generally early to late Holocene in age; and (3) rapid channel incision (downcutting) has occurred within the upper Kellogg Creek floodplain during the past 250 years or less.

## CULTURAL CONTEXT

### PREVIOUS STUDIES

Numerous cultural resources studies have been conducted within the Los Vaqueros Project area over the past 15 years. Consequently, an extensive body of information is available concerning the prehistory, ethnography, and history of the area. Reports detailing the archaeological and architectural surveys, site and building records, summary archaeological inventory report, and the *Evaluation, Request for Determination of Eligibility and Effect* document are on file at the Northwest Information Center (Bramlette et al. 1991; Praetzelis and Praetzelis 1992; SSUAF 1992). Sixty-two of the 68 prehistoric and historic archaeological properties identified within the Los Vaqueros Project (APE) are considered individually eligible to the National Register of Historic Places (NRHP) or are defined as contributing elements to the NRHP district (SSUAF 1992).

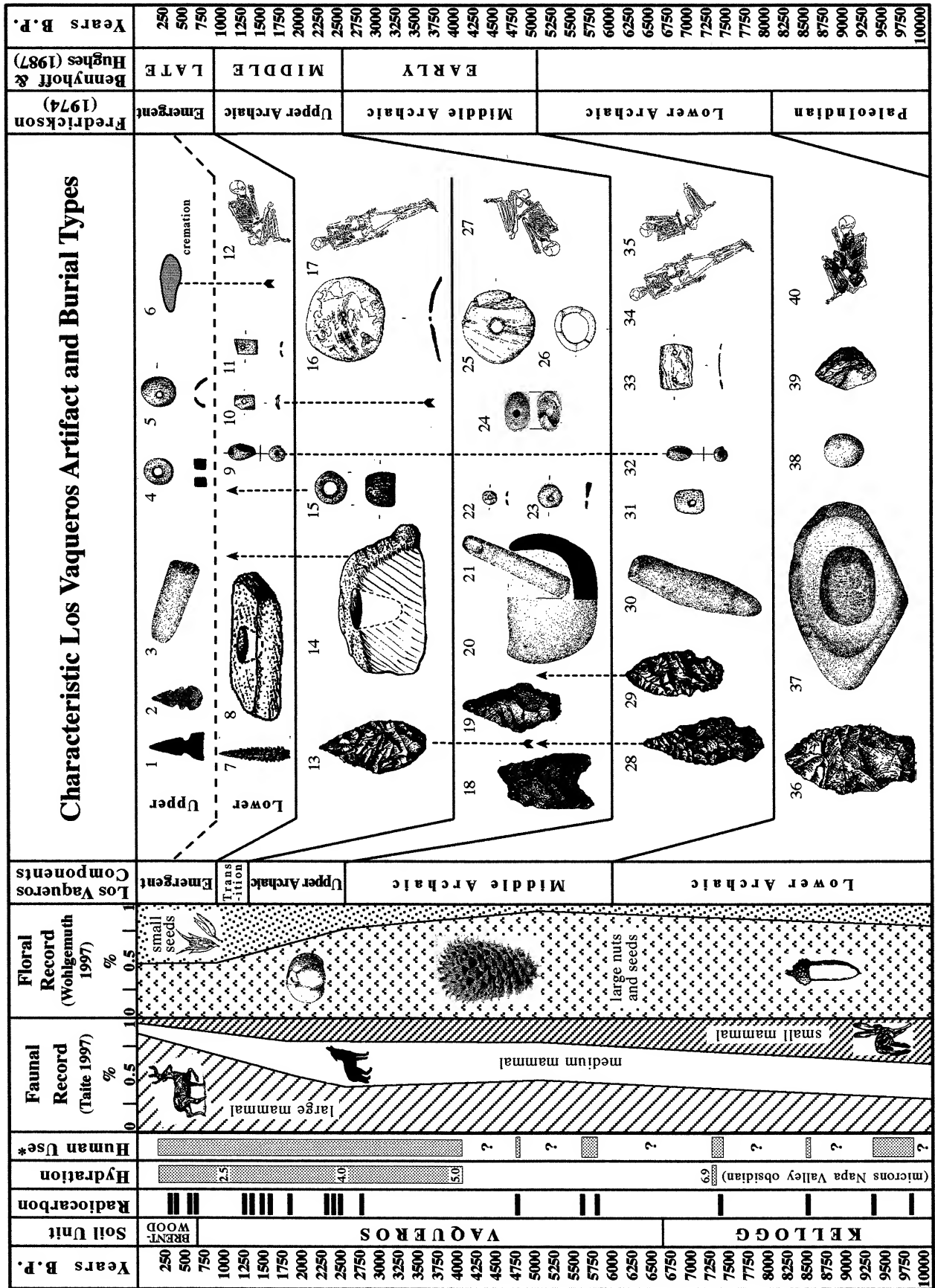
### PREHISTORY AND ETHNOGRAPHY

Recent archaeological and geoarchaeological investigations of prehistoric sites in the Los Vaqueros area have revealed a complex record of prehistoric human occupation (Figure 2) that spans almost 10,000 years (Meyer and Rosenthal 1997). Lower Archaic archaeological materials dating to more than 9000 B.P., as well as human remains dating to 7400 B.P., were identified at site CA-CCO-696 in the upper Kellogg Creek valley. These finds represent some of the oldest well-dated evidence of human occupation so far identified in the region. In addition, a Middle Archaic component, containing one of the oldest dated shell-bead lots in central California (4700 B.P.), was identified at site CA-CCO-637. Despite expectations that Los Vaqueros would have been a marginal environment for human use and occupation before the Emergent period (Bramlette 1989), these investigations found that permanent or semi-permanent residential bases had already been established in the upper Kellogg Creek valley more than 2,000 years ago. It was concluded that the nature and completeness of the archaeological record in the project area had been significantly influenced by the processes of large-scale landscape evolution (Meyer and Rosenthal 1997).

Although there is little ethnographic information available for the study area, a recent synthesis of the Los Vaqueros Project's Native American history studies (Fredrickson, Stewart, and Ziesing 1997) provides a basis for understanding human use of the area before Euro-American contact. According to Milliken (1997b), the Los Vaqueros watershed served as a boundary area among three independent groups that each spoke a distinct language.

In summary, the Kellogg Creek drainage was near the boundary of two neighboring political groups, the *Volvons* [Bay Miwok] and the *Ssaoams* [Costanoan], at the time of Spanish settlement in California. The *Volvons* when all is said and done, seem to have held the peak of Mount Diablo and the rugged lands to the east of the peak. Their villages were along the Marsh Creek drainage, perhaps also at Clayton on the north side of Mount Diablo, or in the other direction in the Kellogg Creek drainage. The *Ssaoams* lived in the dry hills and tiny valleys around Brushy Peak and Altamont Pass, hill lands that separated the Livermore Valley from the San Joaquin Valley. They almost certainly held the high lands south and east of Kellogg Creek, including the Vasco Caves. The *Ssaoams* may also have held the valley of Kellogg Creek itself [Milliken 1997a:30-31].





## Key to Figure 2

No.	Description
1	Panoche Side Notched and Desert Side Notched projectile points made primarily of cryptocrystalline rock
2	Stockton Side Notched and Corner Notched projectile points made only of obsidian
3	Small cylindrical pestles
4	Clam shell disk beads
5	Lipped <i>Olivella</i> beads, Type E
6	Cremation of human remains
7	Stockton Stemmed projectile points made only of obsidian
8	Small block mortars
9	Spire-lopped <i>Olivella</i> beads, Type A1b
10	Thin rectangular <i>Olivella</i> beads, Type M1
11	Thin rectangular <i>Olivella</i> beads, Type M2
12	Tightly flexed burials with variable orientations
13	Shouldered lanceolate projectile point made of obsidian
14	Bedrock mortars (Upper Archaic Period cups larger than Emergent Period cups)
15	Steatite beads
16	<i>Haliotis</i> ornaments, Type CA4fm
17	Ventrally extended burials primarily with northern orientations
18	Concave-base projectile points made of chert and obsidian
19	Contracting-stem projectile point made of chert
20	Shaped and cobble bowl mortars
21	Shaped and cobble pestles
22	Saucer <i>Olivella</i> beads, Type G1 and G2
23	<i>Macoma</i> clam disk beads
24	Split <i>Olivella</i> beads, Type C
25	<i>Haliotis</i> ornaments, Type C1C
26	<i>Haliotis</i> ornaments, Type C2C
27	Tightly flexed burials, primarily with southwest orientation
28	Side-notched projectile point made of chert (CCO-637, Burial 7, 5795 cal B.P.)
29	Side-notched projectile point made of chert (CCO-637, Burial 5, 5665 cal B.P.)
30	Cobble pestles with convex parabolic end-wear
31	Thick rectangular <i>Olivella</i> beads
32	Spire-lopped <i>Olivella</i> beads, Type A1a
33	<i>Haliotis</i> ornament, Type uBA7
34	Fully extended and semi-extended burials, primarily with northwest orientations
35	Loose-flexed burials, primarily with northwest orientations
36	Wide-stem projectile point made of obsidian (CCO-696, 6.9 microns Napa Valley)
37	Millingslabs and oval bifacial handstones
38	Small round handstones
39	Cobble-core tools
40	Cairn burial (CCO-696, Burial 160, 7,400 cal B.P.)
*	Approximate timing and duration of human use in the project area based on combined radiocarbon and obsidian hydration evidence

## INVESTIGATIONS AT CA-CCO-637

### SITE DESCRIPTION

CA-CCO-637 is located at UTM grid coordinates 612100/4188440 (Zone 10), as plotted on the Northwest Information Center base map, USGS Byron Hot Springs, Calif., 7.5' quadrangle. The site was situated at about 300 feet (approximately 91 m) AMSL in a narrow portion of the upper Kellogg Creek valley, within a gently sloping alluvial fan deposit. The proximal portion of the alluvial fan emerges at a point where a small, seasonal drainage exits the moderate to steep hillslopes that lie west of the site (Figure 3A). Prior to construction of the dam and spillway structures, the fan extended three-quarters of the way across the valley before being truncated by the modern Kellogg Creek channel.

CCO-637 was originally described as a sparse surface accumulation of shell and stone flaking debris. The site was recorded south of the alluvial fan, between the hillslope and Kellogg Creek. Field investigation determined that the archaeological deposit was associated with a buried soil that extended throughout the alluvial fan, including a large area outside the Area of Direct Impact of the dam and spillway construction. Based on these results, the site boundaries were adjusted to include the entire fan area. The total site area measured approximately 90 m (north-south) x 180 m (east-west), for a total of 12,723 square meters.

The area in and around CA-CCO-637 has been subject to a variety of earth-moving and construction activities. Construction of the former Vasco Road and a pair of underground gas pipelines had impacted the site across the medial portion of the fan. Other impacts included construction of modern livestock fence and corral structures and the construction and maintenance of a dirt road through the site. While these activities have clearly affected the deposits at CCO-637, they may have been instrumental in bringing the archaeological materials to the surface, leading to identification of the site. Following archaeological mitigation, the area was extensively impacted by the excavation of the spillway stilling basin, the stilling basin drain pipe trench, the spillway outlet canal, the transfer pipeline trench, two drainage ditches, and other project-related structures (Figure 3B).

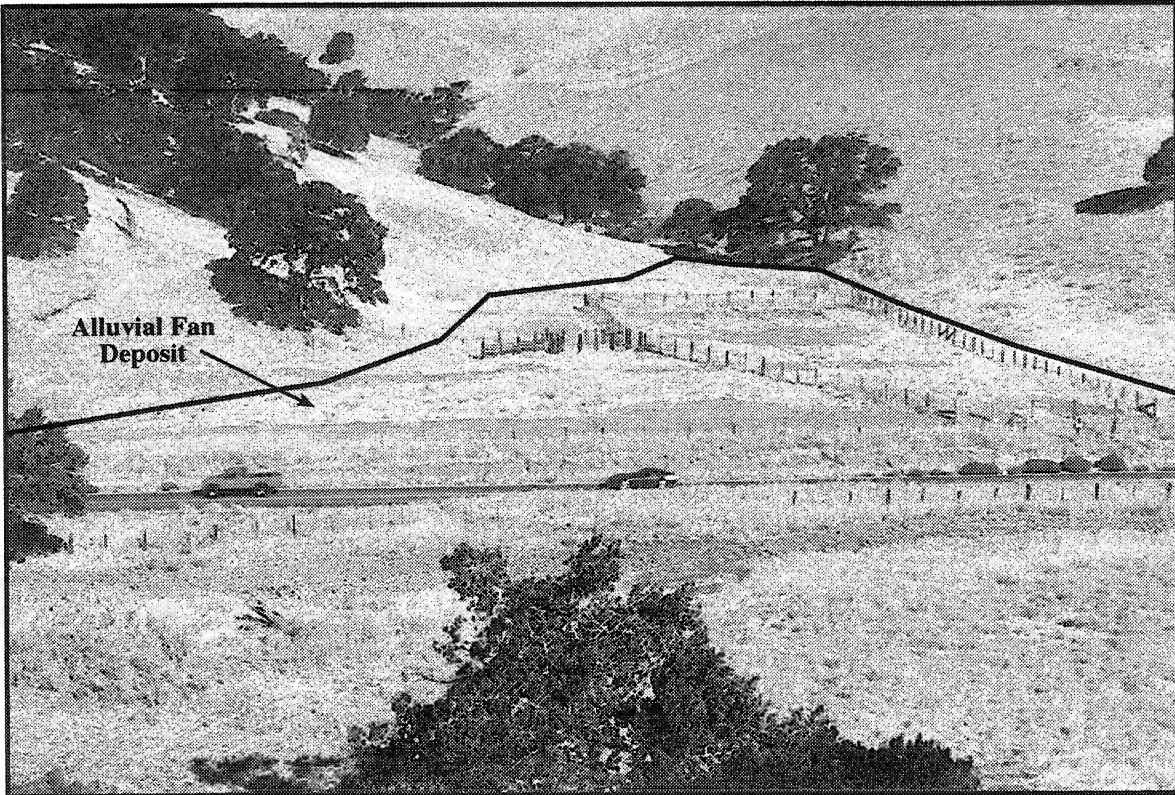
### PREVIOUS FIELD WORK

Field work at CCO-637 was conducted in three phases over a period of about 3 years. The first phase included site mapping, surface inspection, exploratory backhoe-trenching, and the excavation of vertical test units. The second phase included the excavation of subsurface transect units and an area exposure unit. The final phase involved archaeological monitoring and the removal of artifacts and human remains uncovered at the site. Artifacts and human remains recovered between September 1994 and March 1996 were previously analyzed and reported by Meyer and Rosenthal (1997). This study, however, reports on the artifacts and human remains recovered between September 1996 and October 1997, not included in the previous investigation. See Meyer and Rosenthal (1997) for details regarding previous field work and findings.

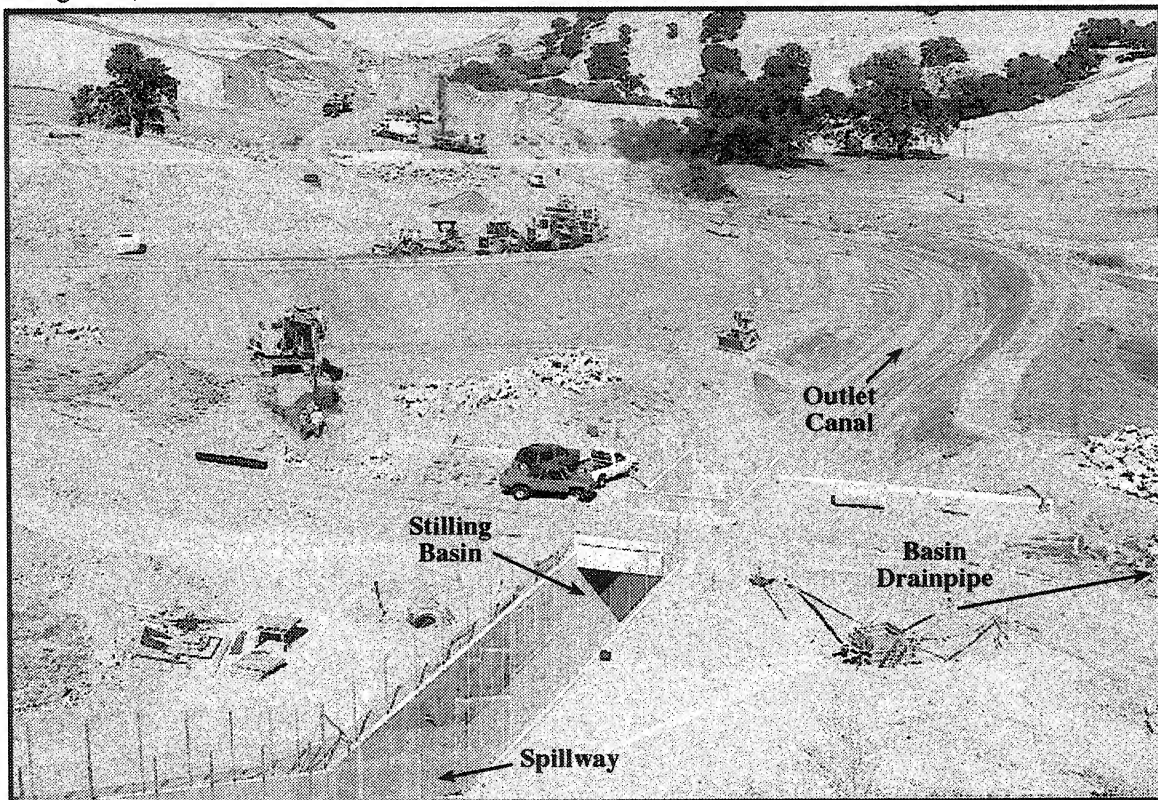
### Construction Monitoring (January to March 1996)

Monitoring was undertaken at CCO-637 to recover any additional human graves that might be exposed during construction excavations. The excavations were monitored by teams composed of two or three archaeologists and a Native American representative. Major construction-related impacts to the site included the excavation for the spillway stilling basin and outlet canal. The excavation for the stilling basin structure was undertaken in a part of the fan that was not tested by archaeological excavations due to the presence of two buried gas pipelines.

At the request of a Native American Most Likely Descendant, bottom-loading paddle-wheel scrapers were used to excavate the spillway stilling basin and portions of the outlet canal. Each pass of the scraper was carefully examined for human burials and artifacts. A 5-m buffer zone was established around human remains as they were encountered, which allowed scraping to continue in



**Figure 3A.** Overview of Alluvial Fan at CCO-637 (photograph taken August 1995 by Jack Meyer facing west)



**Figure 3B.** Overview of Construction at CCO-637 (photograph taken October 1997 by Jack Meyer facing northeast)

other areas. All in-situ artifacts and burials found during monitoring were recorded with reference to one of two datums (M3, M4) established along a barbed-wire fence west of former Vasco Road (Figure 4). Human remains were carefully excavated and placed in a secured storage facility before removal to the ASC Collection Facility for analysis. As of October 1996, an additional 17 human burials (18 total), several artifact types were identified at the site as a result of construction monitoring. The findings from this initial phase of construction monitoring were reported in Meyer and Rosenthal (1997).

## **PREVIOUS FINDINGS**

### **Site Stratigraphy and Formation Processes**

Natural deposits at CCO-637 consist of fine-grained alluvial deposits that were primarily derived from the hillslopes west of the site. The relatively slow but steady accumulation of these deposits at the base of the hillslopes created an alluvial fan that became wider towards Kellogg Creek to the east. Two distinct stratigraphic units, each with some degree of soil development, were identified at the site. Indications of a deeper, but poorly defined, unit was found in some locations within the fan (Figure 5).

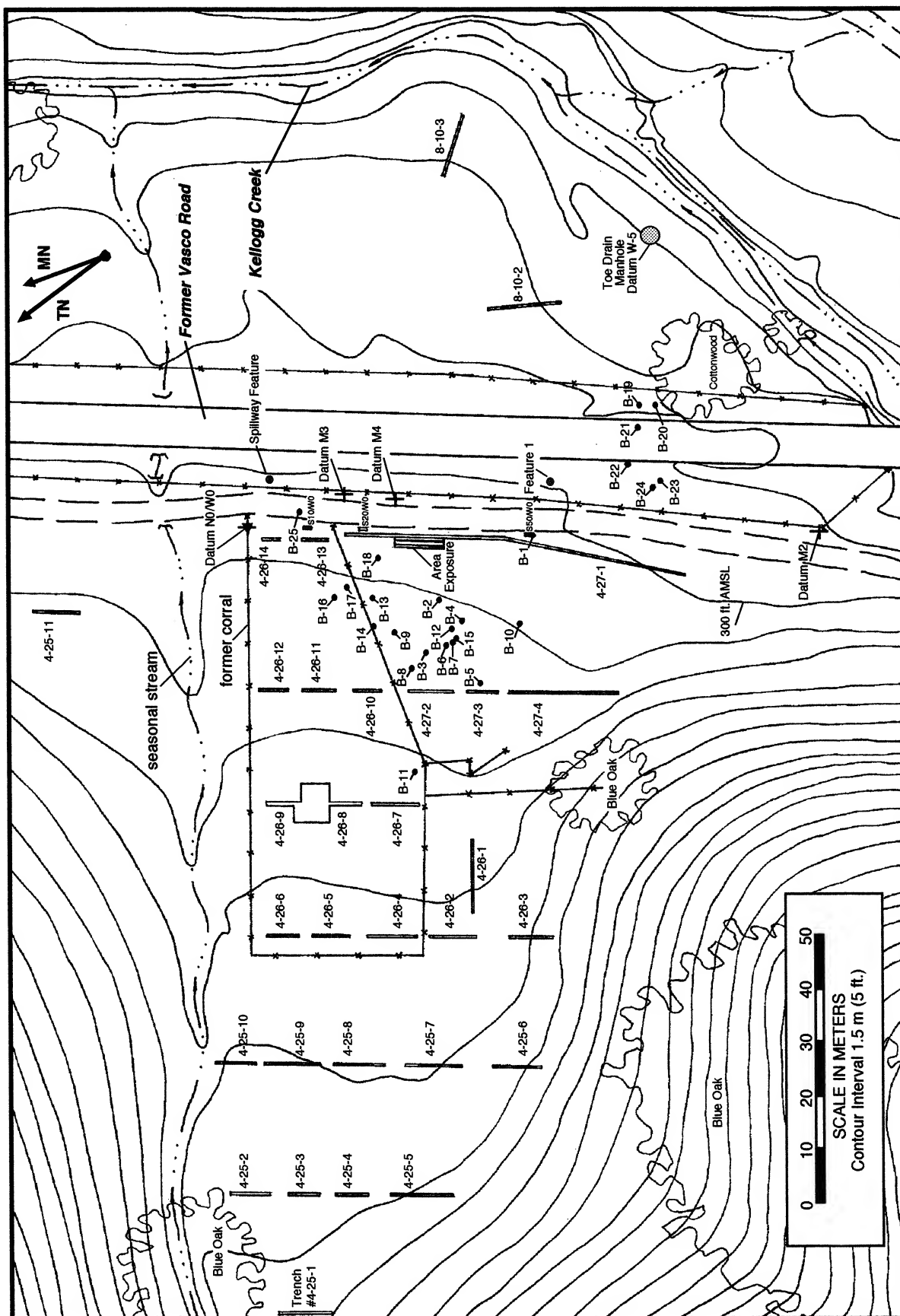
Surface deposits (Unit II) at the site exhibited a weakly developed soil profile similar to that identified elsewhere as the Brentwood floodplain facies (665 to 250 B.P.). Most of the archaeological remains at the site were found at depths of 70 to 130 cm, in association with a buried paleosol identified as the Ab horizon of Unit I (Figure 5). Although no stratigraphic break was identified within Unit I, cultural materials were found to occur in two primary zones. In the area exposure, higher densities of cultural materials were identified above and below the 100- to 110-cm level, which coincide with the vertical distribution of cultural features found in the exposure. Human burials were also found to occur in two general stratigraphic levels, those above 120 cm and those below 145 cm. These distribution patterns suggest that the two levels of cultural materials were vertically separated by a certain amount of sediment within the Unit I deposit. Unit I appears to represent a chronostratigraphic equivalent of the Vaqueros deposit (6355 to 2735 B.P.).

In addition, another possible paleosol (containing many pieces of charcoal) was observed in some parts of the site at depths of 200 to 225 cm, suggesting the presence of a deeper, but poorly defined, stratigraphic unit (Figure 5). This is further supported by the discovery of a few archaeological remains, including human burials, at depths of more than 180 cm, in association with a deposit containing many pieces of charcoal. Finally, the discovery of extinct terrestrial mammal remains (probable camel) near the base of the alluvial fan indicates that it is probably late Pleistocene in age.

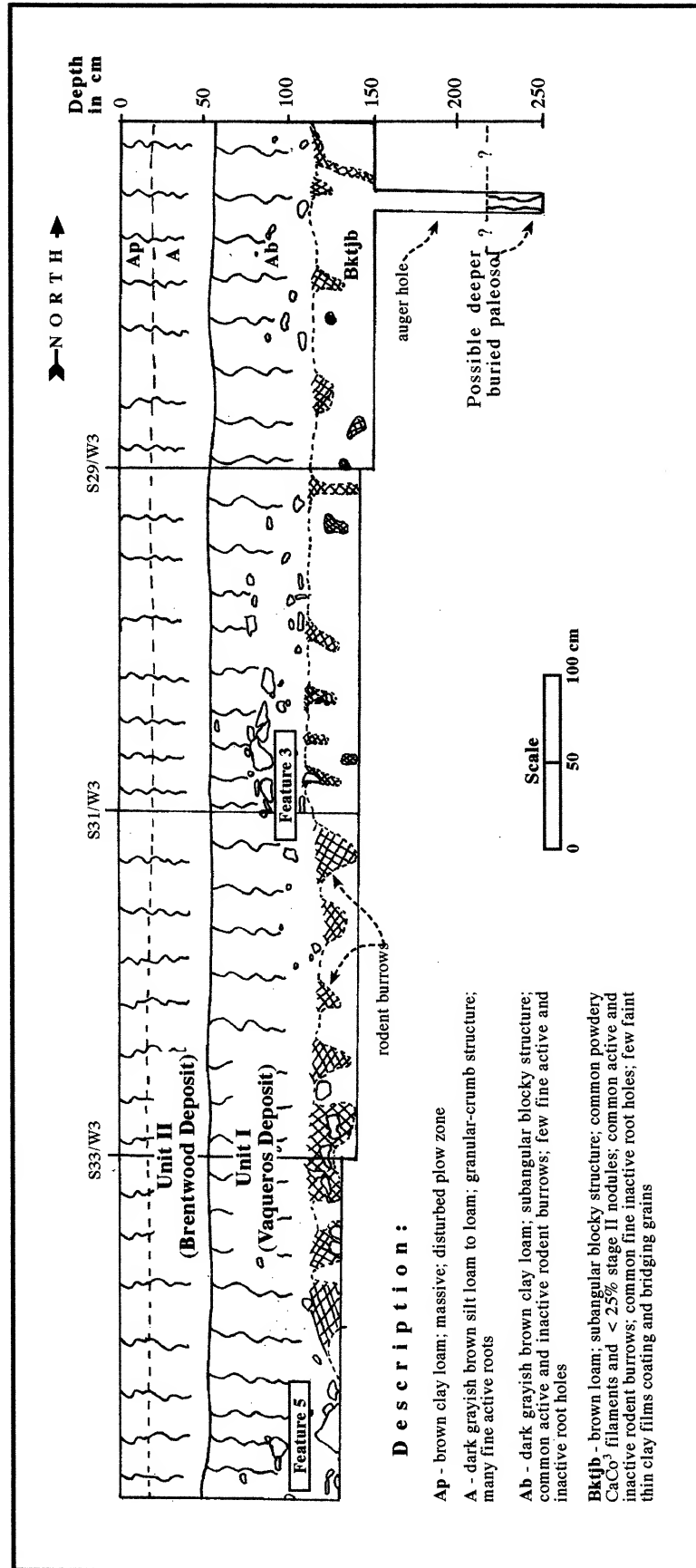
The history of landscape evolution at CCO-637 can be interpreted from the sediments identified at the site. Beginning in the late Pleistocene, alluvium began to accumulate slowly but steadily at the base of the hillslopes, producing an alluvial fan deposit. As soil formation kept pace with deposition throughout most of the Holocene, an over-thickened cumelic A horizon was formed within Unit I. Human occupation of the site appears to have taken place throughout much of the time that Unit I was forming. Sometime between 665 and 250 B.P., the surface of Unit I was buried by the relatively rapid accumulation of alluvium represented by Unit II.

Evidence indicates that post-occupational disturbances have affected the systemic context of the archaeological deposits in some portions of CCO-637. Many active and inactive burrows (krotovina), excavated by various ground-dwelling animals, were observed at the surface of the site, and many burrows were noted in the walls of trenches and the other excavated exposures. A profile of the west wall in the area exposure illustrates that burrowing activity has disturbed many parts of the site matrix. Given these factors, it is likely that some artifacts were displaced from their original systemic context.





**Figure 4.** Site Map Showing Natural and Cultural Features at CCO-637



**Figure 5.** Stratigraphy in the Area Exposure Unit at CCO-637

### **Artifact Assemblage**

The assemblage from CCO-637 included several artifact classes that consisted of at least 17 different material types. The assemblage was composed of over 1200 pieces of bone, more than 900 shell beads, several-hundred flaked-stone artifacts, dozens of freshwater shell and baked-clay fragments, more than a dozen ground-stone artifacts, and at least one bone tool (see Table 1). Artifacts were most frequently composed of (listed in descending order): bone, shell, chert, siltstone, quartzite, obsidian, baked-clay, basalt, and small amounts of other rocks, fossils, and minerals.

### **Flaked Stone**

Flaked-stone artifacts recovered from previous phases of work at CCO-637 include debitage, projectile points, bifaces, cobble tools, core tools, cores, and large modified flakes (Table 1). The projectile points were predominantly side-notched forms associated with burials, although one expanding stem and one leaf-shaped point was collected during hand excavation and monitored grading. Three of the 5 projectile points are chert, 1 is Napa Valley, and 1 is Annadel obsidian.

Based on the degree of pressure flaking, the majority of bifaces from the site appear to be projectile-point fragments. In contrast to the diagnostic projectile points, the bifaces are predominantly Napa Valley obsidian with only 2 chert specimens represented.

Cores were the most numerous of the flaked-stone artifacts. Roughly half of the cores were multidirectionally flaked, while the other half had been worked unidirectionally. The majority of specimens were siltstone, chert, and quartzite. Of the 10 non-siltstone specimens, 7 retained patches of cobble cortex, indicating that they were made from previously rounded cobbles. In addition, two cores and one split cobble exhibited heavily crushed margins and/or flake facets, suggesting that they had been used as tools.

Consistent with the frequency of core material, flaked-stone debitage from the site was dominated by chert (39%), siltstone (31%), and quartzite (11%). Obsidian made up only 9% of the assemblage. Despite the high frequency of cores at the site, only 2 modified flakes were collected, suggesting that such tools may have been discarded at locations offsite.

### **Groundstone**

The majority of groundstone artifacts were pestles, including shaped and unshaped specimens. Only 3 mortars were recovered during previous phases of work at the site. Pestles were made of two material types: sandstone (n=9) and greywacke (n=4). Four specimens had use-wear on opposing ends, while 6 specimens are single-ended. Pestle use resulted in four primary end shapes, including convex parabolic (36%), slightly convex (36%), flat (21%) and convex (7%). Besides the use-wear recorded on the pestle ends, slightly more than half of the specimens from the site (n=7), had pecking scars and extensive use-wear polish on the sides. These additional wear patterns indicate that such implements may have been used for a variety of processing activities.

### **Marine Shell Beads and Ornaments**

The vast majority of shell beads from CCO-637 were recovered in association with Burial 14, including *Olivella* End-Ground, Spire-Lopped, and Thick Rectangular beads. Fourteen small *Olivella* Spire-Lopped beads (Type A1a) were collected during excavation of the area exposure. Four of the beads occurred between 90 and 110 cm and 10 occurred between 120 and 140 cm. A single piece of *Haliotis* shell, possibly an ornament fragment, was found with Burial 9.

### **Baked Clay**

Besides the baked-clay hearth features, several isolated lumps of baked clay were collected from test unit and area exposure excavations. Slightly over 40% of the baked-clay pieces exhibited grass and/or other unidentified impressions. These specimens appear to be daub fragments.



**TABLE 1**  
**CA-CCO-637 ARTIFACT ASSEMBLAGE (Meyer and Rosenthal 1997:III.45)**

<b>Flaked Stone</b>		<b>Groundstone</b>	
Large projectile points		Mortars	
Leaf shaped	1	Large bowl mortar	1
Expanding stem	1	Unique block mortar	1
Side notched	3	Mortar fragment	1
Bifaces		Pestles	
End	1	Cylindrical	4
Margin	2	Slightly shaped	3
Midsection	1	Conical	1
Tip	2	Cobble	3
Large modified flakes		Indeterminate	2
Siltstone	2	Battered cobble	
Cobble tool		Chert	1
Quartzite	1	Basalt	1
Core tools		Siltstone	1
Quartzite	1	<b>Minerals</b>	
Petrified wood	1	Iron oxide	present
Cores		<b>Fossil</b>	
Basalt	1	Oyster-shell fragments	present
Chert	4	<b>Modified Bone</b>	
Siltstone	9	Curved-to-flat	1
Quartzite	4	<b>Shell Beads</b>	
Dacite	1	Olivella	
Debitage		Spire-Lopped	571
Nonobsidian		End Ground	113
Basalt	38	Thick Rectangle	501
Chert	262	Fragments	73
Dacite	5	<b>Faunal</b>	
Granite	2	Mammal/bird bone	1,200
Hornfels	10	Freshwater mussel shell	39
Petrified wood	7	<b>Baked Clay</b>	
Quartz	4	Impressed	16
Quartzite	76	Lumps	21
Rhyolite	2		
Siltstone	205		
Slate	1		
Soapstone	1		
Obsidian			
Annadel	2		
Bodie Hills	10		
Napa Valley	51		

### **Faunal Bone**

The faunal assemblage from CCO-637 is dominated by large (46%) and medium-size mammal bone (36%). Small mammal (18%) and bird bone (0.3%) makes up roughly 20% of the collection. Identified fish remains from the site are limited to two resident freshwater species (Sacramento perch and Sacramento squawfish).

### **Faunal Shell**

Several pieces of freshwater mussel shell were collected, however, only one specimen (*Gonidea angulata*) could be identified.

### **Features**

Seven features were identified during previous phases of work at CCO-637, including one rock hearth, 2 baked-soil hearths, and 4 refuse scatters. One formal feature was recorded during construction, one was identified during road-cut examination, one was found in an excavated test unit, and four were recorded in the area exposure. Additional loose aggregations of fire-affected rocks were observed during construction monitoring, but these were not formally recorded. A radiocarbon age of 2585 cal B.P. was obtained from Feature 1 (a baked-clay hearth) at a depth of about 100 cm below the surface (see Figure 4 for location).

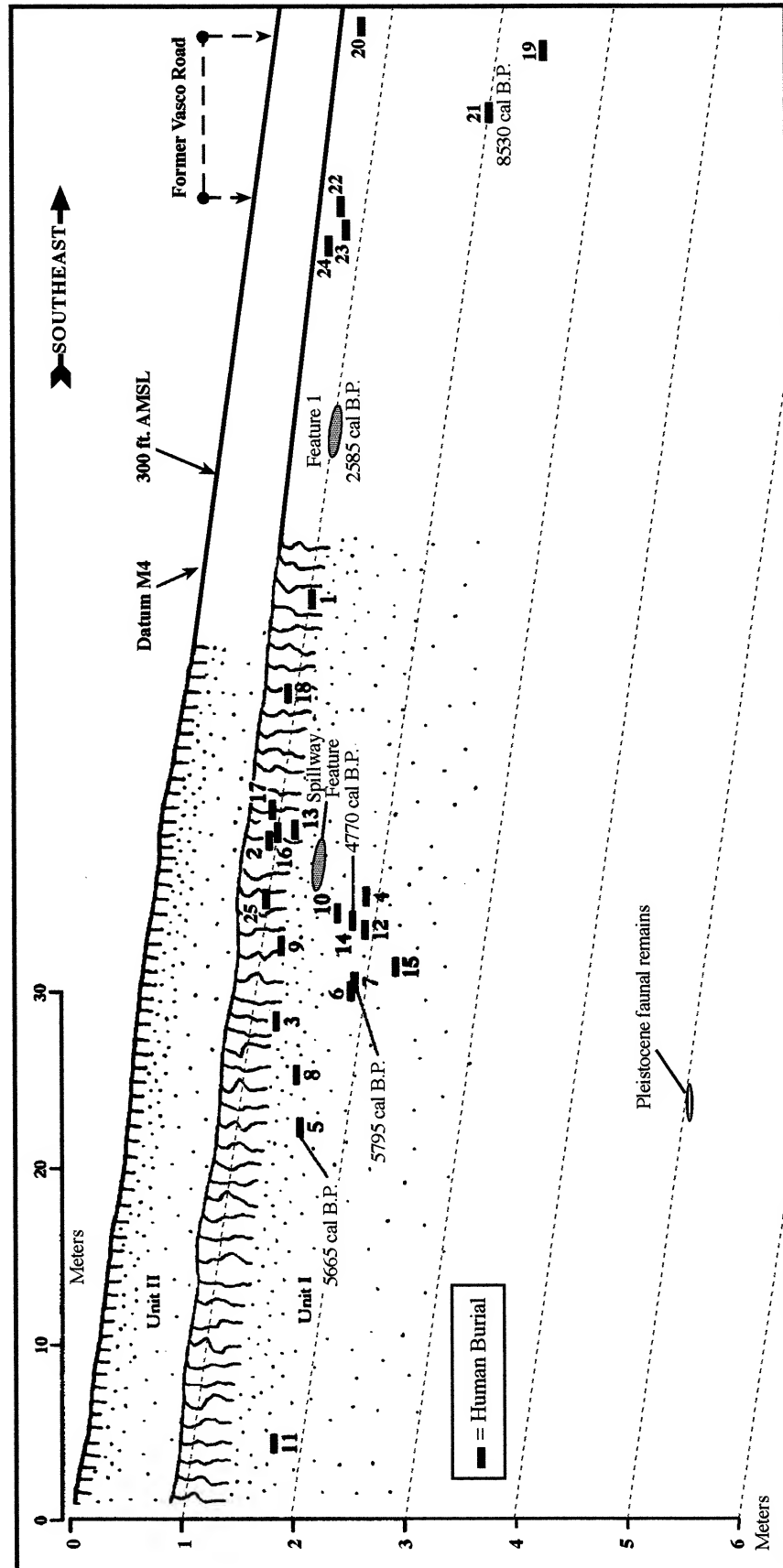
Features identified at CCO-637 appeared to be distributed between two stratigraphic zones within the Ab horizon of Unit I. The vertical separation between features was most clearly distinguished in the area exposure. Features associated with the upper zone were found at maximum depths of 100 cm below surface or less. Those associated with the lower zone were found at maximum depths ranging from 117 to 130 cm below surface. The vertical distribution of features corresponds well with the higher densities of cultural material above and below the 100- to 110-cm level in the area exposure, indicating the presence of at least two general habitation layers at the site.

### **Burials**

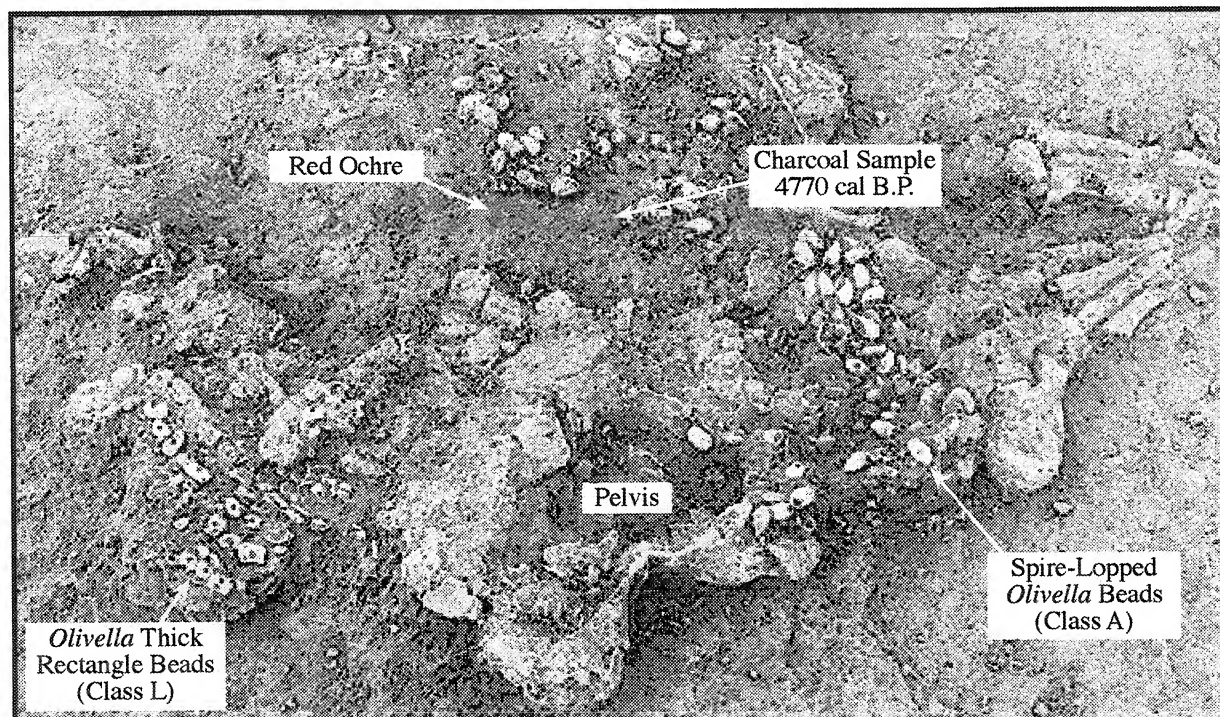
Human remains representing a total of 18 individuals were recovered during previous phases of work at the site, including 1 encountered during vertical unit excavation, and 17 during archaeological monitoring. Two distinct concentrations of burials, separated vertically by approximately 25 cm of alluvium, were identified. The burials were distributed between two zones coinciding with the A and B horizons of Soil Unit I (Figure 6). The upper zone ranged from 86 to 122 cm below surface and included 8 burials, the majority of which were highly disturbed. Two of these burials were found in a tightly flexed burial position. Burial orientation, recorded for only 3 individuals, were primarily toward the southwest quadrant, ranging from 180 to 280 degrees (magnetic north). Two burials from the upper zone had artifact associations (a lump of iron oxide and a *Haliotis* shell fragment).

Ten burials were contained in the lower zone, which ranged from 145 to 221 cm below surface (Figure 6). A variety of burial positions were recorded, including 2 tightly flexed, 2 loosely flexed, 2 semi-extended, and 3 extended; the position of 1 individual could not be determined. In contrast to burials from the upper concentration, all the deeper burials were oriented towards the northwest quadrant, from 270 to 357 degrees (magnetic north).

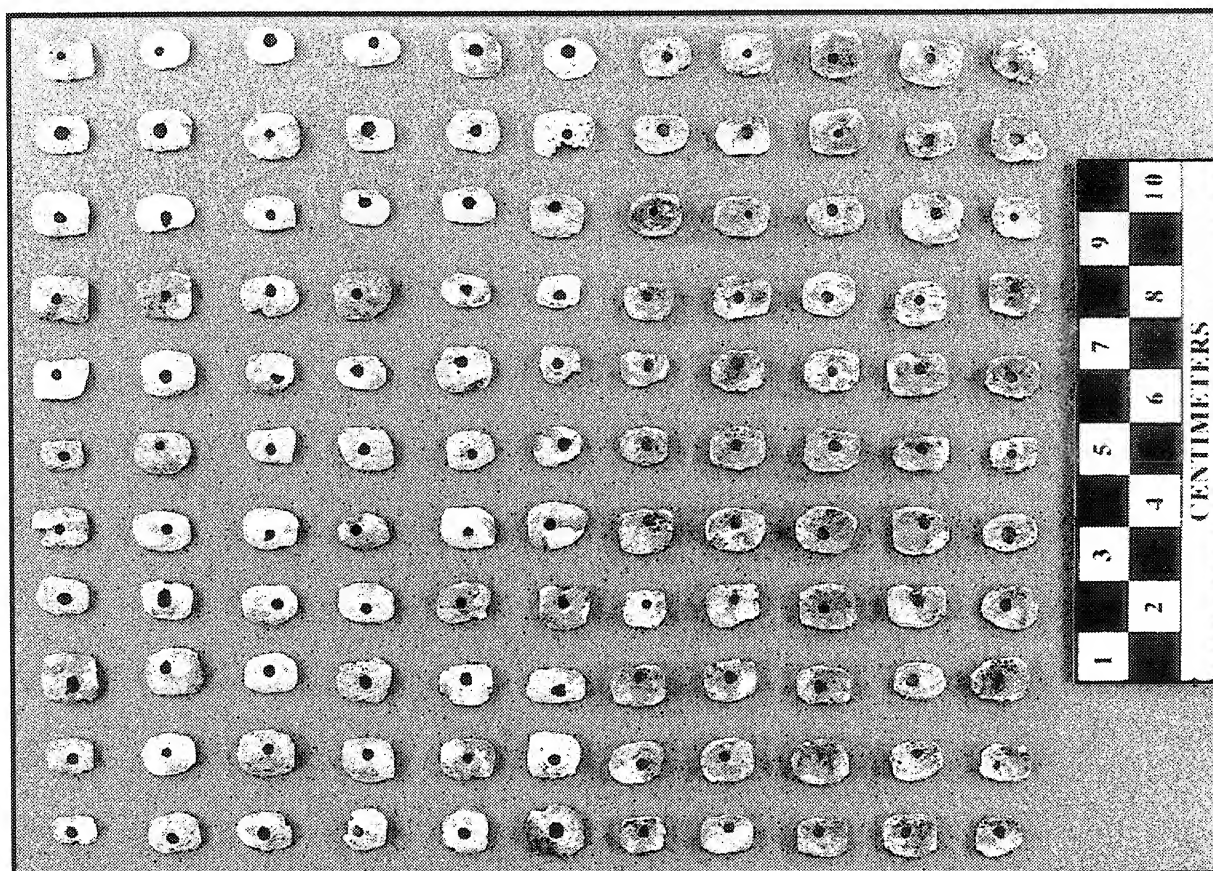
Artifacts were associated with three of the deeper burials. Red ochre and *Olivella* beads were found with Burial 14 (Figure 7A). Along with the pigment, a thin, concentrated, lens of charcoal was identified directly below the skeletal remains, interpreted as evidence for a preinterment fire. A sample of charcoal collected from this lens produced a radiocarbon date of 4770 cal B.P. Three side-notched projectile points were recovered with two other burials. A complete chert point was found with Burial 5 and a complete chert point and a point base of a Napa Valley obsidian was associated with Burial 7. Large concentrations of charcoal were identified in the matrices of Burial 5 and Burial 7, although no distinct lens was recognized. Samples of charcoal from both burials



**Figure 6.** Schematic Cross Section of CCO-637 (note the depth of dated feature and burials)



**Figure 7A.** Marine-Shell Bead Lot with Burial 14 at CCO-637



**Figure 7B.** Class L *Olivella* Thick Rectangle Beads from Burial 14 at CCO-637

were submitted for radiocarbon dating, resulting in dates of 4950 +/- 90 and 5090 +/-80, or 5665 and 5795 cal B.P. respectively.

### **Chronological Data**

#### **Radiocarbon Dates**

Four radiocarbon dates were initially obtained from CCO-637. Charcoal samples were collected from three deeply buried burials (Burial 5, 7, and 14). These samples produced radiocarbon dates ranging from 5795 to 4770 cal B.P. Another date of 2585 cal B.P., associated with the upper habitation zone, was obtained from Feature 1, a baked-clay hearth identified in the Roadcut Profile.

#### **Obsidian Hydration**

A total 64 obsidian specimens were submitted for hydration analysis, producing 59 usable hydration readings (see Appendix A). The sample was made up of four different obsidian sources (Napa Valley, Bodie Hills, Annadel, and Casa Diablo); the majority were Napa Valley (80%). Hydration readings from the Napa Valley obsidian ranged from 4.7 to 1.3 microns (3388 to 260 B.P.); Bodie Hills ranged from 3.6 to 1.9 microns; and Annadel and Casa Diablo specimens produced rim values of 1.4 and 2.6 microns respectively. Obsidian-hydration readings from the area exposure were analyzed by depth, revealing no significant patterning.

Hydration readings were obtained from a projectile point and a biface fragment associated with Burial 7. Both specimens produced identical rim values of 3.0 microns (1380 B.P.). These hydration readings conflict with the radiocarbon date also associated with Burial 7. Although the hydration dates may call into question the radiocarbon date, there are two primary reasons to believe that the hydration results may be in error: (1) Burial 7, located almost 2 meters below the surface, was one of the deepest interments found at the site; and (2) a similar radiocarbon date was obtained from Burial 5, also associated with a side-notched projectile point.

#### **Shell Beads**

The combination of shell-bead types recovered from the site is diagnostic of the Middle Archaic period (Bennyhoff and Hughes 1987: Scheme B1). A radiocarbon date (4770 cal B.P.) associated with the beads from Burial 14 is consistent with this chronological placement.

### **CURRENT FINDINGS**

#### **Construction Monitoring (September 1996 to October 1997)**

The final phase of monitoring at CCO-637 was undertaken to recover any additional human graves that might be exposed during construction excavations. The excavations were monitored by teams composed of two or three archaeologists and a Native American representative. Major construction-related impacts to the site included the excavation for a portion of the transfer pipeline, the stilling basin drainpipe, the majority of the spillway outlet canal, and two trapezoidal drainage ditches. The excavations for sections of the transfer pipeline and stilling basin drainpipe were undertaken in a part of the site that was not tested by archaeological excavations due to the former presence of Vasco Road and a buried fiber-optic cable.

A large excavator with a flat-bucket was used for the excavations at the request of a Native American Most Likely Descendants. Each pass of the bucket was carefully examined for human burials and artifacts. A 5-m buffer zone was established around human remains as they were encountered, which allowed excavation to continue in other areas. All in-situ artifacts and burials found during monitoring were recorded with reference to one of two datums (M3, M4) established along a barbed-wire fence west of former Vasco Road (Figure 5). Human remains were carefully excavated and placed in a secured storage facility before removal to the ASC Collection Facility for analysis.

## **Site Stratigraphy**

Only limited observations regarding site stratigraphy were made during the final phases of construction monitoring. Two distinct stratigraphic units, and a third deeper, but poorly defined unit, were identified at the site as was found by the previous investigations (Meyer and Rosenthal 1997). Deposits near the original ground surface exhibited a weakly developed soil profile similar to that previously identified in the Kellogg Creek floodplain as the Brentwood deposit (Unit II, 665 to 250 B.P.). No intact archaeological materials were found to occur within this unit.

The majority of archaeological materials were found at depths of 70 to 130 cm, in association with a buried paleosol identified as the Ab horizon of Unit I. Unit I appears to represent a chronostratigraphic equivalent of the Vaqueros deposit (6355 to 2735 B.P.) identified within the Kellogg Creek floodplain by Meyer and Rosenthal (1997). In addition, a fire-hearth feature was found within the spillway outlet canal at a depth of about 150 cm below surface, and two ground-stone artifacts were recovered from depths of more than 175 cm within the stilling basin drainpipe trench. Human burials were found to occur either above 140 cm or below 190 cm, indicating the presence of at least two occupational levels separated by about 50 cm of sediment. The burials and artifacts found at the deeper levels appear to be associated with a poorly defined stratigraphic unit (containing many pieces of charcoal and freshwater shell) that was identified as a possible paleosol during previous phases of work at the site.

## **Artifact Assemblage**

### **Flaked Stone and Flaked-Stone Materials**

Flaked-stone artifacts recovered during the final phases of work at CCO-637 include 1 obsidian, flake, 1 obsidian projectile point fragment, and 3 cores (1 quartzite, 2 dacite) (Table 2). Visual-sourcing indicates that the projectile point is composed of obsidian originating from the Napa Valley source. The original source of the obsidian flake could not be determined visually due to the weathered condition of the specimen.

Cores were the most numerous of the flaked-stone artifacts. Two of the cores were multidirectionally flaked (95-7-440, -442), while the third had been worked unidirectionally (97-5-441). All retained patches of cobble cortex, indicating that they were fashioned from previously rounded cobbles. In addition, one core exhibited crushed margins along some surfaces, suggesting that it had been used as a tool. Two cores were made of dacite and the third from quartzite. No core tools or modified flakes were found during this phase of work at the site.

### **Cobble Tools**

Two cobble tools were recovered and classified as hammerstones. One was made of dacite (95-7-433) and the other was made of quartzite (95-7-429). Both retained patches of cobble cortex indicating that they were fashioned from previously rounded cobbles. Both specimens exhibited evidence of extensive battering, crushing, and pecking on numerous surfaces, indicating that they were used as tools.

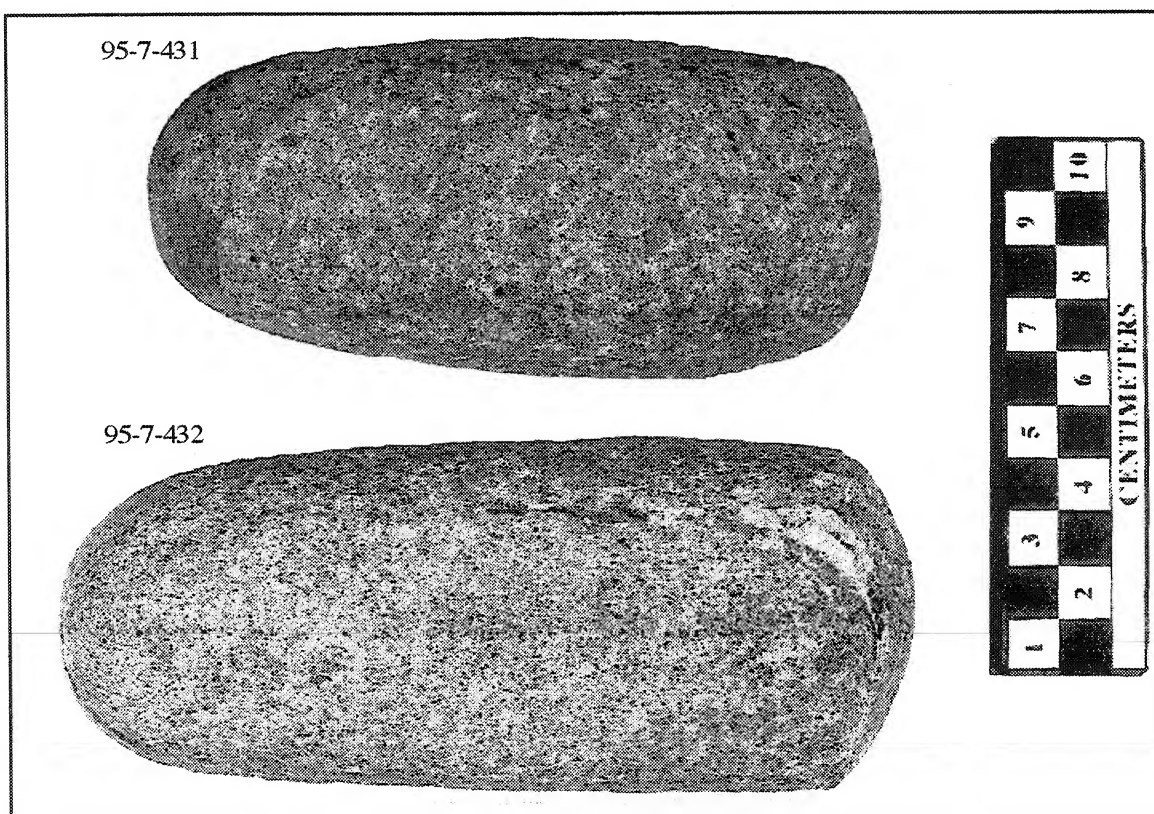
### **Groundstone**

Nine groundstone artifacts were recovered at CCO-637 during the final phases of construction monitoring. As before, the groundstone assemblage was dominated by pestles (n=5), including both shaped (n=2) and unshaped (n=3) specimens (see Figure 8A and 8B). All the pestles were made of greywacke. Three complete specimens exhibited use-wear on opposing ends, while use-wear was noted on the single-end of two incomplete specimens. Evidence of spalling and battering were found on 3 specimens (95-7-428, -430, -436). These additional wear patterns suggest that these implements were used for a variety of processing activities. Pestle use resulted in four primary end shapes, including convex parabolic (6), and slightly convex (2). Besides the use-wear on the pestle ends, extensive pecking scars were evident on the sides of 2 specimens (95-7-431, -432).



**TABLE 2. ARTIFACTS RECOVERED DURING FINAL MONITORING PHASES**

<b>FIELD #</b>	<b>ACC #</b>	<b>CAT #</b>	<b>DESCRIP. 1</b>	<b>DESCRIP. 2</b>	<b>DESCRIP. 3</b>	<b>MATERIAL</b>	<b>COUNT</b>	<b>WEIGHT</b>	<b>AREA</b>	<b>DEPTH</b>
CM-1	95-7	427	BIFACE	PROJECTILE POINT	-	OBSIDIAN	1	2.4	BASIN DRAIN	-
CM-2	95-7	428	GROUNDSTONE	PESTLE	COBBLE	GREYWACKE	1	2475	BASIN DRAIN	-
CM-3	95-7	429	COBBLETOOL	HAMMERSTONE	-	QUARTZITE	1	470	BASIN DRAIN	-
CM-4	95-7	430	GROUNDSTONE	PESTLE	COBBLE	GREYWACKE	1	518	BASIN DRAIN	175-200
CM-5	95-7	431	GROUNDSTONE	PESTLE	SHAPED	GREYWACKE	1	1025	BASIN DRAIN	-
CM-6	95-7	432	GROUNDSTONE	PESTLE	SHAPED	GREYWACKE	1	600	BASIN DRAIN	-
CM-7	95-7	433	CORE	-	-	DACITE	1	413	BASIN DRAIN	-
CM-8	95-7	434	GROUNDSTONE	CHARMSTONE	SHAPED	SCHIST	1	151	BASIN DRAIN	-
CM-9	95-7	435	GROUNDSTONE	MORTAR	COBBLE	SANDSTONE	1	5850	BASIN DRAIN	050-125
CM-10	95-7	436	GROUNDSTONE	PESTLE	COBBLE	GREYWACKE	1	525	BASIN DRAIN	050-125
CM-11	95-7	437	GROUNDSTONE	MORTAR	BOWL	ANDESITE	1	7650	TRANS. PIPE	050-100
CM-12	95-7	438	FAUNAL	-	-	BONE	28	0.3	TRANS. PIPE	000-100
CM-13	95-7	439	GROUNDSTONE	INDETERMINATE	INDETERMINATE	SANDSTONE	1	196.1	BASIN DRAIN	240-240
CM-14	95-7	440	COBBLE TOOL	HAMMERSTONE	-	DACITE	1	436.2	SPILL WAY	060-120
CM-15	95-7	441	CORE	-	-	DACITE	1	140.7	SPILL WAY	060-120
CM-16	95-7	442	CORE	-	-	QUARTZITE	1	123.9	SPILL WAY	-
CM-17	95-7	443	FLAKE	-	-	OBSIDIAN	1	0.01	SPILL WAY FEATURE	140-160
CM-18	95-7	444	FAUNAL	-	-	BONE	81	0.7	SPILL WAY FEATURE	140-160



**Figure 8A.** Shaped Pestles from CCO-637



**Figure 8B.** Cobble Pestles from CCO-637 (note calcium carbonate on 95-7-430)



A bowl mortar made of andesite (95-7-437) was recovered from the transfer pipeline trench, and a cobble mortar made of sandstone (95-7-435) was found during excavation of the stilling basin drainpipe trench (see Figure 9A and 9B). The bowl mortar had a 40 mm diameter hole punched through its base, an indication that it was intentionally "killed" before being discarded. The cobble mortar and one of the shaped pestles (95-7-432) were found at about the same depth (90 cm) less than 20 cm apart, suggesting that the two had been used together. An unidentified groundstone fragment made of sandstone (95-7-439) was found at a depth of about 240 cm near Burial 19. The specimen exhibits some pecking on its outer surface and a small area of polish on its inner surface, and has a reddish color due to thermal-alteration. Although the specimen cannot be positively identified, it is probably a mortar or millstone fragment.

In addition, a conditionally complete perforated oval charmstone was recovered (the only one to be identified at the site). The specimen, fashioned from glaucophane (blue) schist with small garnet inclusions, measured 135 mm in length, 27 mm in width, and 22 mm in thickness (Figure 10). The charmstone has a sub-cylindrical-oval shape that narrows at one end much like a cigar. A perforation (8 mm in diameter) was bi-conically drilled at a point about 36 mm from the specimen's narrow end. A longitudinal bifacial-groove (1 mm in depth and 3 mm in width) was formed on both sides of the charmstone's narrow end between the perforation. Some battering and spalling are apparent on the large end of the charmstone, which were subsequently ground or otherwise smoothed. Although the specimen appears to have been shaped and polished along each side, a certain amount of asymmetry is evident in the charmstone's overall design and form.

#### **Faunal Bone**

Small fragments of faunal bone were recovered from soil contained in a bowl mortar (95-7-437) found in the transfer pipeline trench (95-7-438), and from soil contained in a fire-hearth feature found in the spillway outlet canal (95-7-444). An examination of the bone fragments from the bowl mortar revealed that about 25% (n=7) of the bone had been burnt, while about 16% (n=13) of the bone from the spillway outlet feature showed similar evidence. Although most of the bone was too fragmentary for further identification, a few small mammal teeth and phalanxes are present in the sample from the spillway outlet feature that may be identified to the family and/or species level.

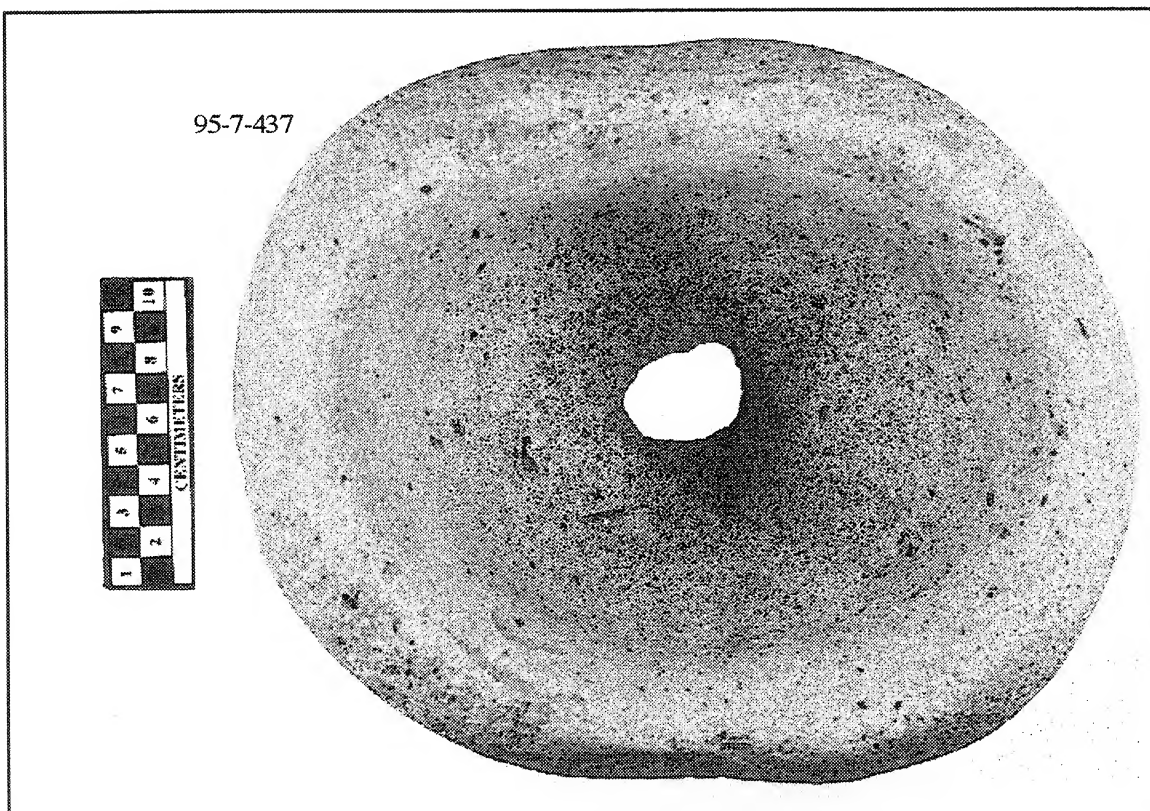
#### **Faunal Shell**

Numerous pieces of freshwater mussel shell were observed during construction monitoring beginning at depths of about 180 cm below surface but were not collected. A piece of freshwater shell was also found near Burial 19 at a depth of about 240 cm below surface, however, the species of this specimen could not be determined.

#### **Feature (Spillway Outlet)**

A well-defined fire-hearth feature was exposed during the excavation of the spillway outlet canal at a depth of about 150 cm below surface (see Figures 6 and 11 for location). The feature appeared as a concentration of sandstone rocks and reddened soil about 1 m in diameter that contained bits of charcoal. A 15 liter soil sample was collected from charcoal concentration within the feature and subjected to water flotation to recover and identify charred plant remains and other archaeological material. An obsidian flake and more than 80 small bone fragments were found within the heavy fractions of the soil sample (see Faunal Bone above). Hydration analysis revealed that the obsidian flake had a rim value of 2.0 microns, however, the obsidian source could not be determined due to excessive weathering.

A 2.5 gram sample of light fraction was recovered from the soil sample and subsequently analyzed by the project's archaeobotanist, Eric Wohlgemuth (see Appendix B). Analysis revealed the presence of both large nuts and berry pits (acorn, buckeye, and manzanita) and small seeds (red maids/miners lettuce and grass). The occurrence of the large taxa is consistent with previous findings in which the archaeobotanical assemblage from CCO-637 was dominated by large nuts and berries, including gray pine. The examination of the 0.4 mm size grade and subsequent



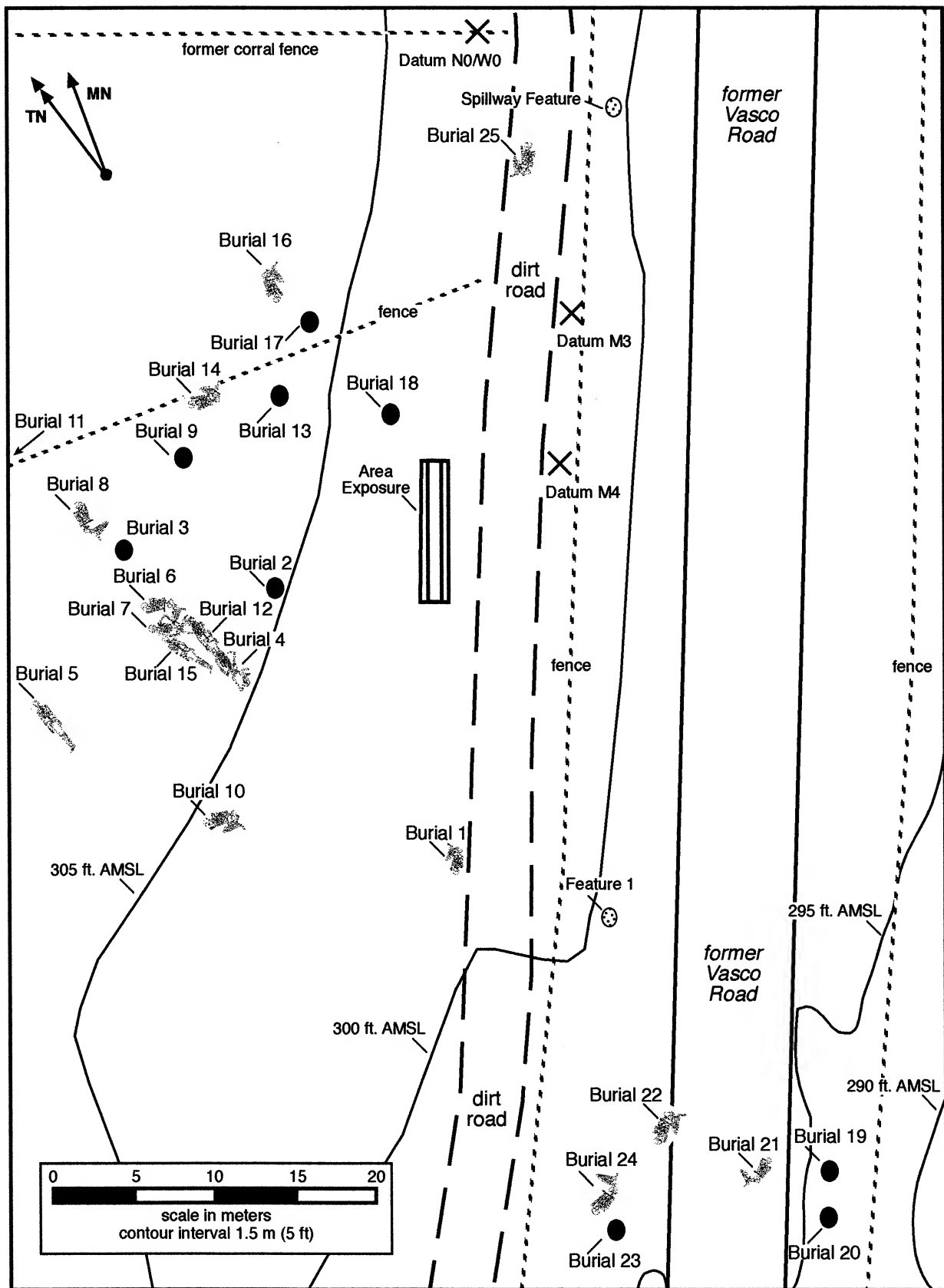
**Figure 9A.** Andesite Bowl Mortar from CCO-637



**Figure 9B.** Sandstone Cobble Mortar from CCO-637



**Figure 10.** Perforated Charmstone from CCO-637 (note groove on narrow-end)



**Figure 11. Position, Orientation, and Distribution of Burials at CCO-637**

discovery of numerous red maids/miners lettuce seeds makes this sample distinctive among the contexts analyzed from the site. Although it is possible that these small seeds are unique to this sample, it is likely that they are present in some or all the unanalyzed 0.4 mm portion of the previously analyzed contexts (see Appendix B).

### **Burials**

Human remains representing a minimum of 7 individuals were recovered during the final phases of work at the site, including 6 encountered during the excavation for the stilling basin drainpipe trench, and 1 during the excavation for the spillway outlet canal (Figure 11). Two distinct concentrations of burials were identified, those above 140 cm and those below 190 cm (see Figure 6). The remains of 5 individuals (Burials 20, 22, 23, 24, and 25) were identified as coming from the upper zone, while 2 individuals (Burials 19 and 21) were found within the lower zone. All the remains were in a poor to fair state of preservation, with some found in contexts that were clearly disturbed (see Appendix C).

Seven adults, with a minimum age ranging from 18 to 35 years, were represented among these remains. These included the remains of at least 3 males (Burials 20, 22, and 23), however, the sex of the other 4 individuals could not be determined. Evidence of pathologic dental attrition, resorption, and enamel hypoplasia were found in 4 of the individuals (Burials 19-22)(see Table 3). Appendix C contains more details regarding the human remains including metric measurements.

The 5 individuals for which burial position could be determined included, 3 in tight-flexed and 2 in loose-flexed positions. Burial orientation recorded for 4 individuals ranged widely from 30 to 240 degrees (magnetic north). Burials 22 and 24 from the upper concentration were oriented towards the southwest quadrant (227 and 240 degrees magnetic north), while Burial 21 from the deeper concentration was oriented towards the east (90 degrees magnetic north). A radiocarbon date of 7800 +/- 50 B.P. (8530 cal B.P.) was obtained from a charcoal sample associated with Burial 21 (see Appendix D). While no formal artifacts were found directly associated with these burials, a freshwater shell and groundstone fragment were found near Burial 19.

### **Chronological Data**

#### **Stratigraphy**

The existence of cultural strata at the site was indicated by two primary zones of archaeological materials that occurred at distinctly different depths. Materials in the upper zone were found between about 60 to 140 cm below surface, while materials in the lower zone were found between about 180 to 240 cm below surface. Materials in the upper zone appear to be associated with the chronostratigraphic equivalent of the Vaqueros deposit (approximately 6300 to 650 B.P.). Materials in the lower zone appear to be associated with the chronostratigraphic equivalent of the Kellogg deposit (approximately 10,300 to 7200 B.P.) identified in the Kellogg Creek floodplain by Meyer and Rosenthal (1997).

#### **Radiocarbon Date**

A charcoal sample collected from the soil matrix within the chest area of Burial 21 (200 cm below surface) was submitted to Beta Analytic, Inc. for radiocarbon dating. The sample produced a date of 7800 +/- 50 B.P. (8530 cal B.P.) indicating that the burial is early Holocene in age (see Appendix D).

#### **Obsidian Hydration**

Two obsidian specimens were submitted for hydration analysis; a projectile point fragment (95-7-427) found in backdirt spoils and a flake (95-7-443) from the feature identified in the spillway outlet canal. Visual characteristics indicate that the point was made of obsidian obtained from the Napa Valley source. The weathered condition of the flake prohibited the visual determination of obsidian source. A hydration rim value of 2.9 microns was obtained from the point, while a rim value of 2.0 microns was obtained from the flake (Appendix A). These hydration

TABLE 3. SUMMARY DATA OF HUMAN REMAINS FROM CCO-637

Burial No.	Age Min.	Age Max.	Age Class	Sex	Pathology	Measurements	Non-metrics	Position	Side	Orientation Degrees MN	Cultural Component
1	20	30	adult	F	no	no	no	tight flex	left	205	Upper Middle Archaic
2	18	plus	adult	indet.	no	no	no	indet.	indet.	indet.	Upper Middle Archaic
3	16	plus	adol/adult	indet.	no	yes (pc)	no	indet.	indet.	indet.	Upper Middle Archaic
4	25	35	adult	M	yes (d,m)	yes (d,pc)	no	semi-extended	right	340	Lower Middle Archaic
5	20	24	adult	indet.	yes (d,e)	yes (d,pc)	no	extended	ventral	340	Lower Middle Archaic
6	22	26	adult	F	yes (d,e,m,p)	yes (d,pc)	no	loose flex	right	290	Lower Middle Archaic
7	20	25	adult	F-	yes (e,h)	yes (d)	no	semi-extended	right	290	Lower Middle Archaic
8	19	25	adult	F+	yes (d,e)	yes (c,d,pc)	yes	loose flex	left	357	Lower Middle Archaic
9	18	22	adult	M	no	yes (c,d,pc)	yes	indet.	left	280	Upper Middle Archaic
10	18	30	adult	F+	yes (h)	yes (d)	no	tight flex	right	280	Lower Middle Archaic
11	30	plus	adult	indet.	yes (d)	no	no	indet.	indet.	indet.	Lower Middle Archaic
12	13.5	15	adolescent	indet.	yes (d,e,h)	yes (c,d,pc)	yes	extended	dorsal	indet.	Lower Middle Archaic
13	18	plus	adult	F-	no	yes (c)	yes	indet.	indet.	indet.	Upper Middle Archaic
14	30	35	adult	indet.	no	yes (d,pc)	no	tight flex	left	270	Lower Middle Archaic
15	10	12	juvenile	indet.	yes (d,e,h)	yes (d)	no	extended	dorsal	322	Lower Middle Archaic
16	18	plus	adult	indet.	no	yes (d)	no	tight flex	right	180	Upper Middle Archaic
17	25	plus	adult	indet.	no	yes (pc)	no	indet.	indet.	indet.	Upper Middle Archaic
18	18	plus	adult	indet.	yes (h)	yes (d,pc)	no	indet.	left	indet.	Upper Middle Archaic
19	25	plus	adult	indet.	yes (h)	yes (d,pc)	no	indet.	indet.	indet.	Lower Archaic
20	35	plus	adult	M+	yes (d)	no	no	indet.	indet.	indet.	Upper Middle Archaic
21	26	29	adult	indet.	yes (h)	yes (pc)	no	loose flex	left	58	Lower Archaic
22	30	plus	adult	M+	yes (d)	yes (d,pc)	no	tight flex	right	193	Upper Middle Archaic
23	18	plus	adult	M-	no	no	no	tight flex?	indet.	indet.	Upper Middle Archaic
24	18	plus	adult	indet.	no	no	no	loose flex	left	240	Upper Middle Archaic
25	18	plus	adult	indet.	no	no	no	tight flex?	right	30	Upper Middle Archaic

Key for Sex, Pathology, and Measurements: + = probable; - = possible; c = cranial; d = dental (excluding hypoplasia); e = enamel extension; h = dental hypoplasia; m = congenital absence of third molar; p = enamel pearl; pc = post-cranial.

readings convert to approximately 1,300 and 600 years before present respectively, based on conversion equations established for Napa Valley obsidian (Origer 1987; Tremaine 1989, 1993).

### **Charmstone**

Typologic and stylistic analysis of the charmstone recovered from the upper zone of the site (sub-cylindrical-oval shape, end-perforated with an over-the-end bifacial-groove) suggests that it is similar to forms associated with early Berkeley Pattern components found in the San Francisco Bay area (Rhodes 1995). The age of the component, considered to be Middle Archaic period (approximately 5000 to 2500 B.P.) is in agreement with other chronological indicators from the site. The slight asymmetry of the charmstone suggests it may be a transitional type, which follows a stylistic-trend towards asymmetric-forms during the Upper Archaic period (Rhodes 1995).

## **SYNTHESIS AND SUMMARY OF FINDINGS**

### **SYNTHETIC APPROACH**

The findings of this investigation have provided several new pieces of information that are important for understanding the archaeological significance of CCO-637. The following sections summarize the findings for categories in which new or additional details have become available since the analysis by Meyer and Rosenthal (1997). Where appropriate, the new data have been integrated with earlier findings to provide a synthesis of all findings at CCO-637.

### **ARTIFACT ASSEMBLAGE**

#### **Flaked Stone and Flaked-Stone Materials**

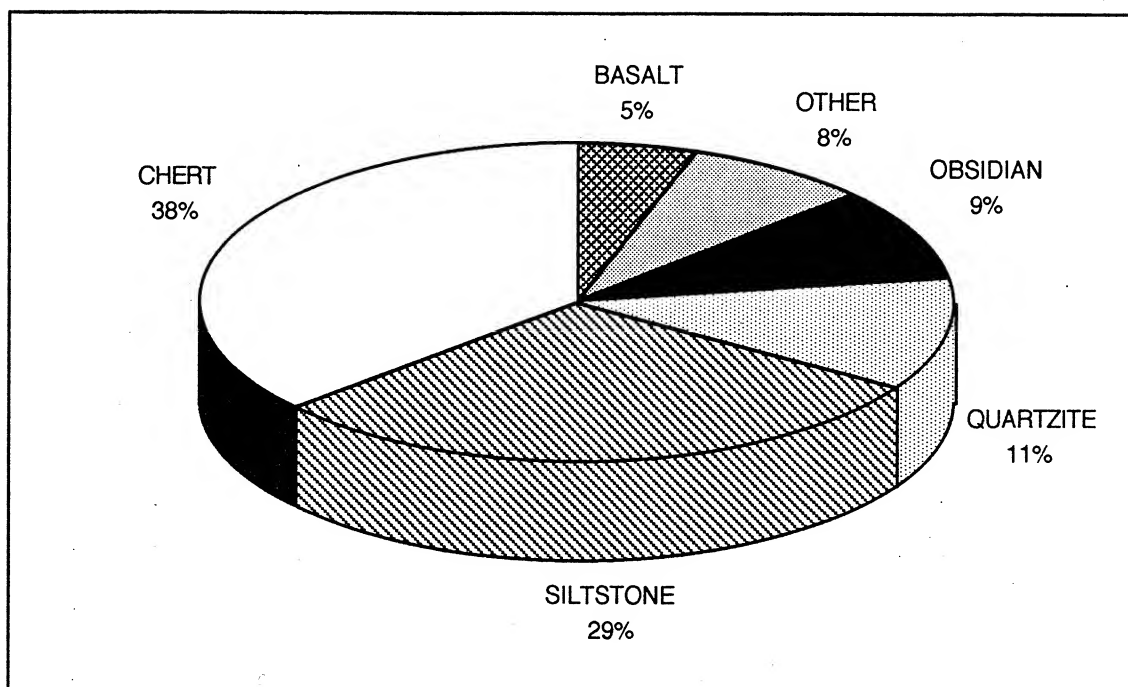
More than two-thirds of the flaked stone assemblage included artifacts made of chert and siltstone, while the remaining one-third was made of quartzite, obsidian, basalt, and other rocks or minerals (Figure 12A). Flakes and formal artifacts made of chert out-numbered those made of obsidian by a ratio of nearly 4 to 1. Figure 12B shows that although chert was the most frequent flaked-stone material, it was the third most common by weight, ranking behind siltstone (38%) and quartzite (25%). The predominance of siltstone flaking debris is viewed primarily as a reflection of its local availability, but may also indicate the preferential use of siltstone for the manufacture of expedient tools. The vast majority of these materials were found at a depth of 60 to 130 cm below surface.

#### **Groundstone**

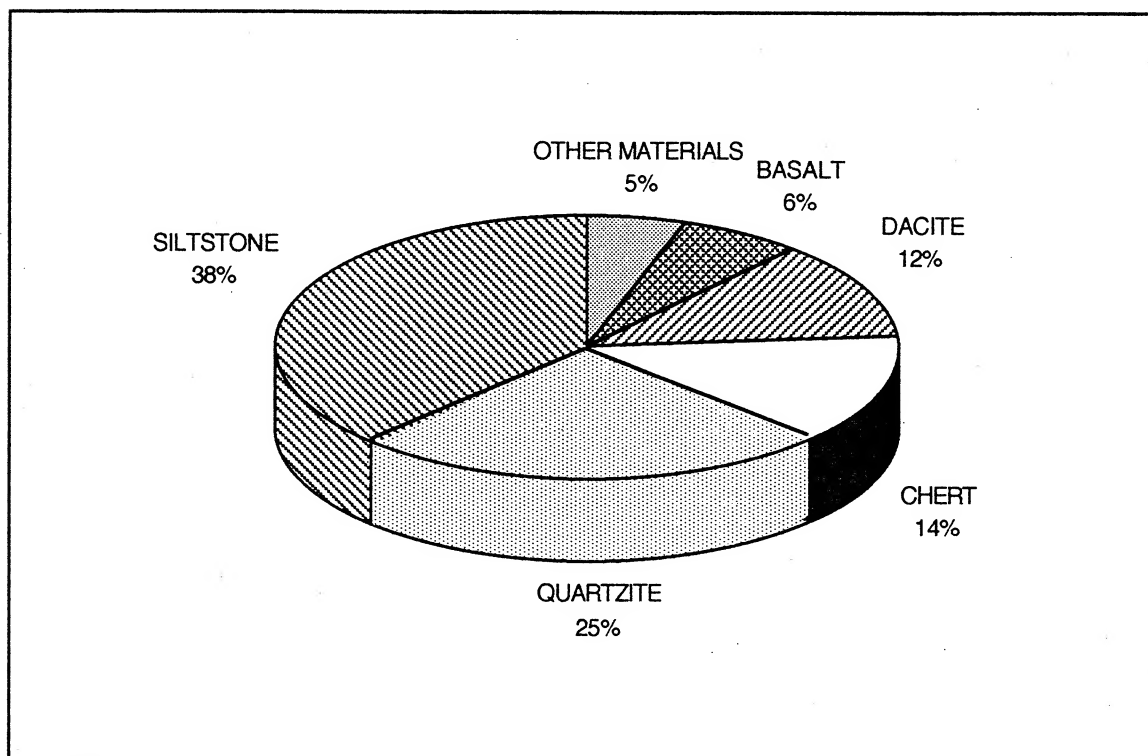
The groundstone assemblage from CCO-637 is composed of 18 (72%) pestles, 5 (20%) mortars, 1 (4%) charmstone, and 1 (4%) indeterminate piece. Nearly one-half (48%) of the groundstone assemblage was made of greywacke, followed by sandstone (44%) and two other rock types (8%). Of the 25 groundstone artifacts recovered, 21 (84%) were classified as formal types, including 10 shaped pestles, 6 cobble pestles, 2 bowl mortars, 2 cobble mortars, and 1 charmstone (see Figure 13). Two-thirds (n=12) of the pestles were made of greywacke, while the remaining one-third (n=6) were made of sandstone. Four of the five mortars were also made of sandstone. Although most artifacts were recovered from the upper cultural zone (60 to 130 cm), a pestle fragment and an indeterminate piece of groundstone, were found in the lower cultural zone (180 to 240 cm).

The amount and variability of use-wear patterns observed in the groundstone assemblage suggests that these implements were used for processing of plant foods and a variety of other activities. Archaeobotanical evidence from the site indicates that gray pine nuts and manzanita berries were processed at the site (Wohlgemuth 1997). The utilitarian appearance of the charmstone suggests that it may have been used as a net-weight or line-sinker for fishing or capturing game. In addition, evidence of planned obsolescence and intentional discard is indicated by the occurrence of a "killed" bowl mortar at the site.



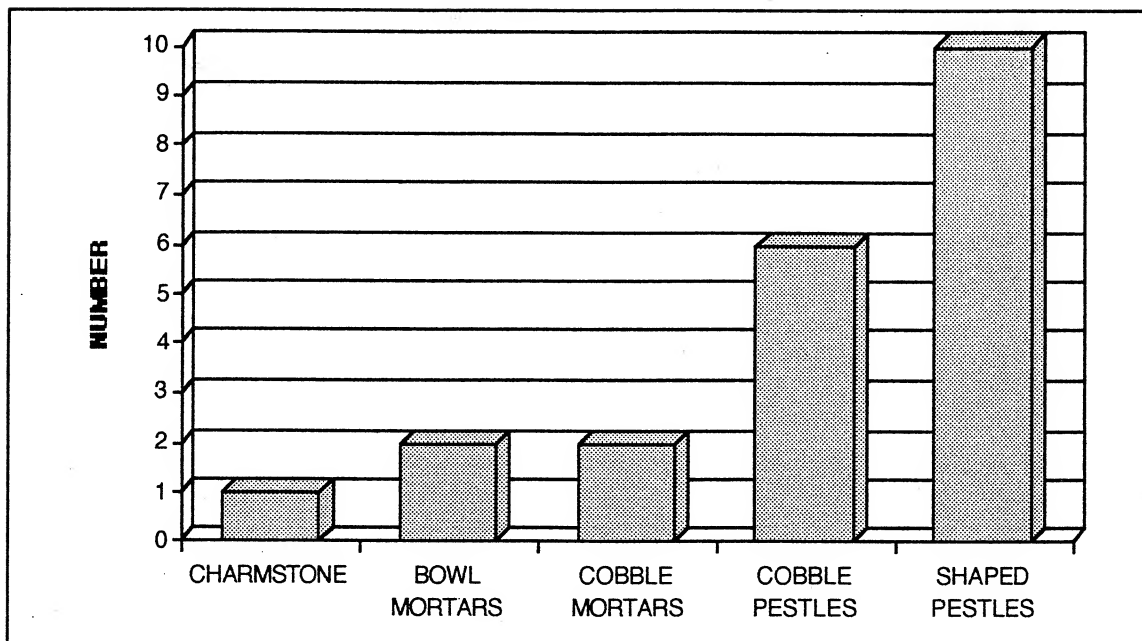


**Figure 12A.** Percentage of Flaked-Stone Materials at CCO-637 by Frequency

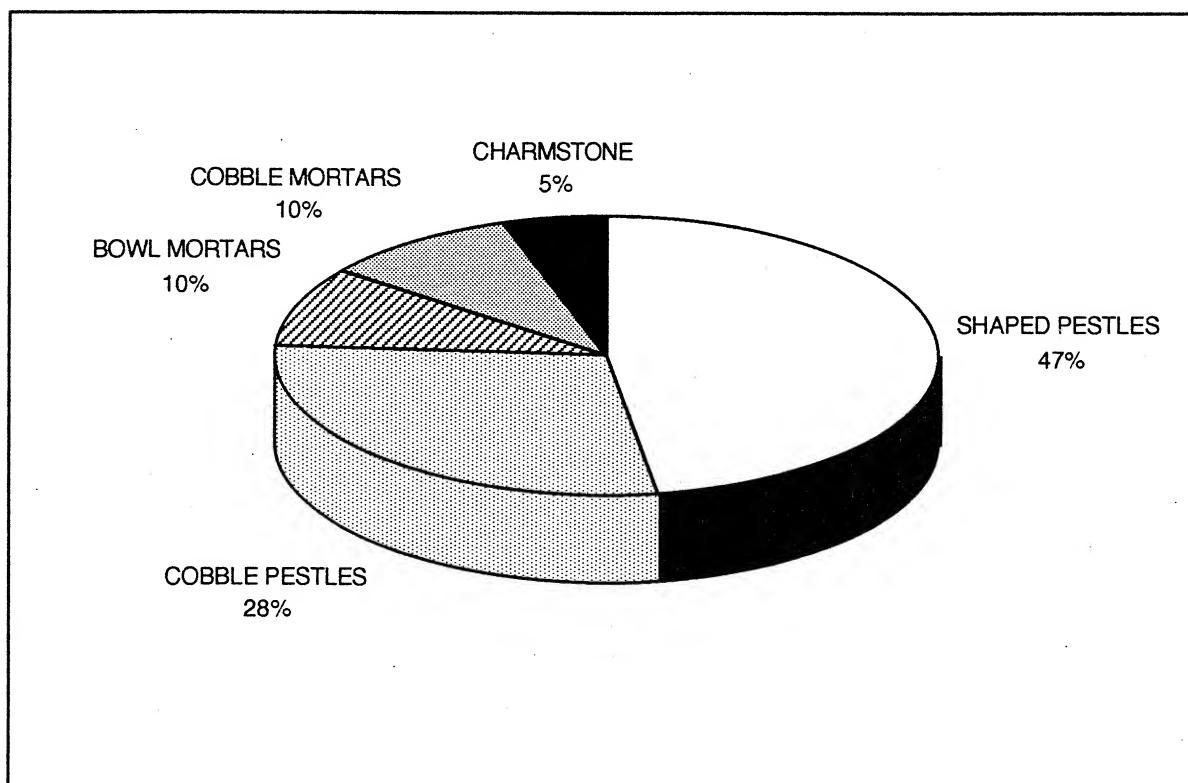


**Figure 12B.** Percentage of Flaked-Stone Materials at CCO-637 by Weight





**Figure 13A.** Frequency of Formal Groundstone Artifacts at CCO-637



**Figure 13B.** Percentage of Formal Groundstone Artifacts at CCO-637

## Human Remains

A total of 25 individual human remains was at CCO-637 (Table 3). The majority of these remains were in a poor to fair state of preservation, with some found in contexts that were clearly disturbed. The remains were concentrated in two major zones that were situated between about 90 to 150 cm and about 180 to 240 cm below the original ground surface. Charcoal samples collected from the matrices in and around the skeletons of four burials were submitted for radiocarbon dating with the following results:

<i>Burial Number</i>	<i>Conventional 14C Date B.P.</i>	<i>Calibrated Years B.P.</i>
14	4140 +/-80	4770
5	4950 +/-90	5665
7	5090 +/-80	5795
21	7800 +/-50	8530

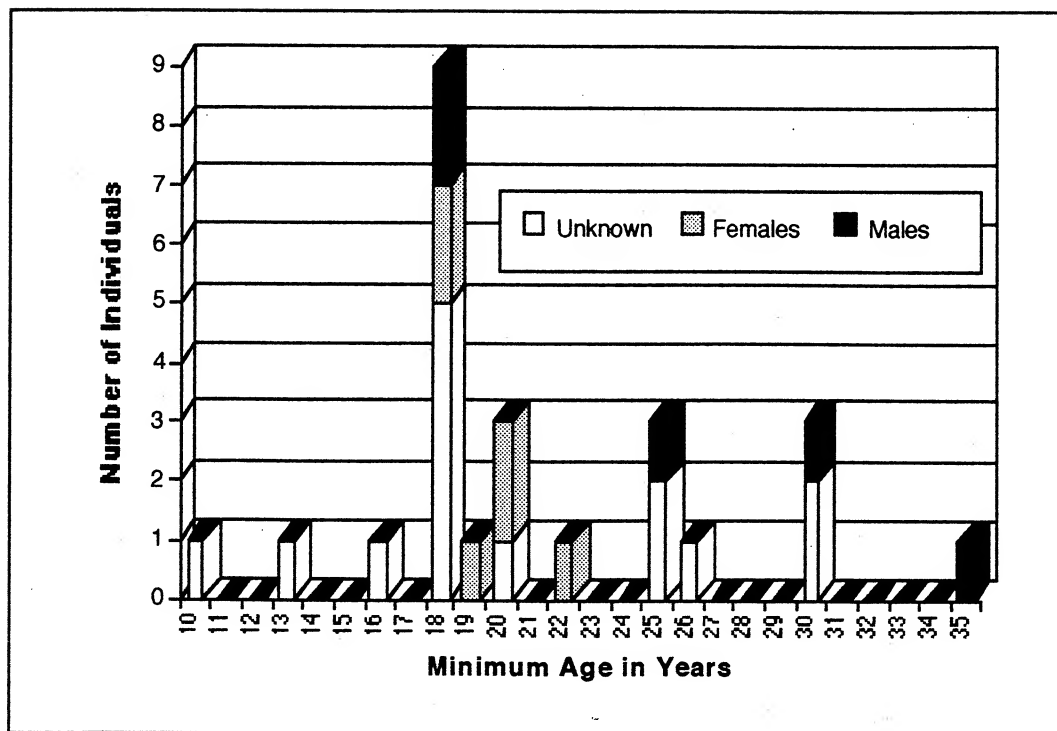
The remains represent 3 children with minimum ages ranging from 10 to 16 years, and 22 adults ranging from 18 to 35 years (Figure 14A). It appears that at least 4 males (Burials 4, 20, 22, and 23) and 6 females (Burial 1, 6, 7, 8, 10, and 13) were represented in this group. The sex of the remaining individuals could not be determined. Evidence of pathologic dental attrition, resorption, and enamel hypoplasia were identified in 14 (56%) of the individuals (see Table 3 and Appendix B).

The 16 individuals for which burial position was determined included, 7 tight-flexed, 4 loose-flexed, 2 semi-extended, 3 fully extended, and 9 unknown (Figure 14B). Excluding unknown burial positions, all the upper Middle Archaic burials were in loose- or tight-flexed positions, while 55% of the lower Middle Archaic burials were in loose- or fully extended positions. A Lower Archaic burial was identified in a loose-flex position. The lower Middle Archaic burials were the most variable in position, with 2 tight-flexed (22%), 2 loose-flexed (22%), 2 (22%) semi-extended, and 3 (33%) fully extended (Figure 14B).

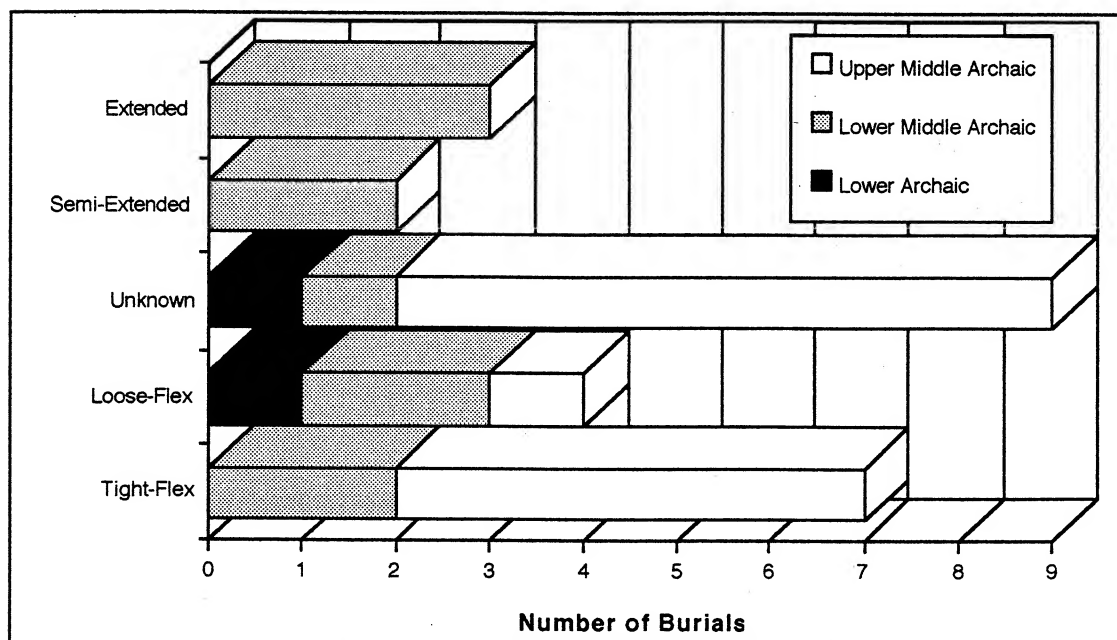
Figure 15 illustrates that the orientation (direction from pelvis to cranium) of 15 burials ranged widely from about 30 to 350 degrees (magnetic north), with most of the upper Middle Archaic oriented towards the southwest (180 to 280 degrees magnetic north), and most of the lower Middle Archaic burials oriented towards the northwest (280 to 350 degrees magnetic north).

## CULTURAL CHRONOLOGY

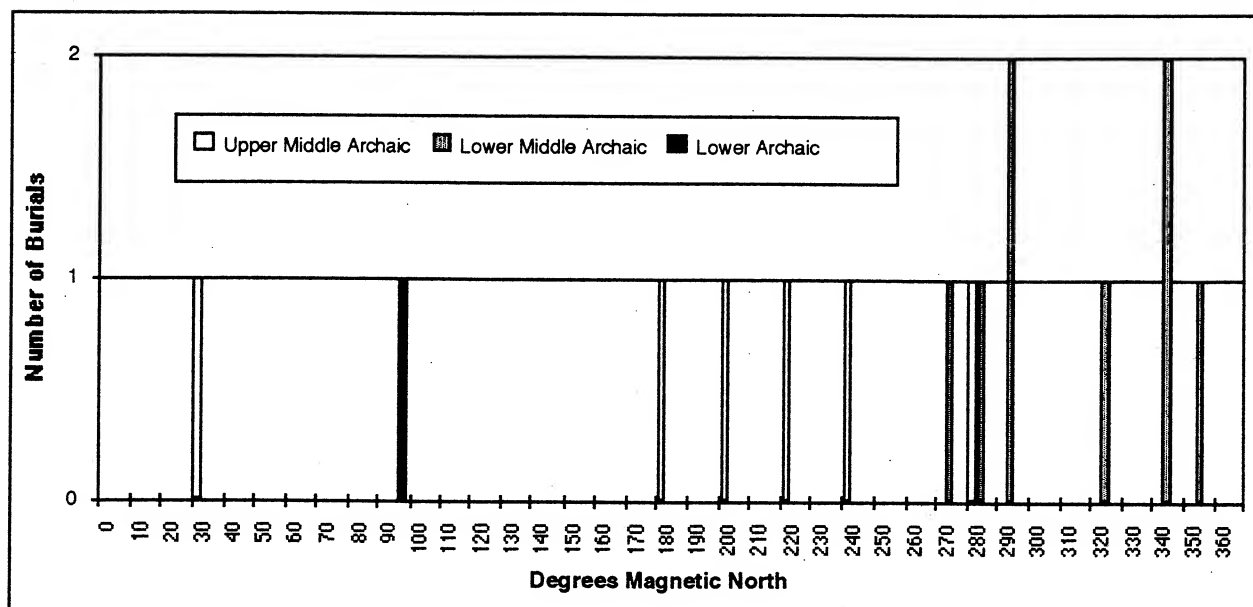
Evidence of early Holocene human occupation at CCO-637 is indicated by the occurrence of two deeply buried human graves and a radiocarbon date of 8530 B.P. The Lower Archaic period component is the second early Holocene-age site to be found in the upper Kellogg Creek drainage near the Los Vaqueros dam. The site was more intensively occupied during the Middle Archaic period (ca. 6000 to 2500 B.P.) as supported by four radiocarbon dates ranging from 5795 to 2585 cal B.P. and one temporally diagnostic shell bead-lot. A comparison of radiocarbon dates obtained from the Los Vaqueros Project area indicate that the dates from CCO-637 fill in significant gaps in the Lower and Middle Archaic periods (Figure 16). The occurrence of mixed burial postures, a general lack of grave goods, and an exclusive use of the mortar and pestle suggest that the Middle Archaic assemblage from CCO-637 represents an unusually early manifestation of the Berkeley pattern. This adaptation appears in Los Vaqueros area about 1,000 years earlier than the chronology proposed by Fredrickson (1974). Despite several rim values ranging from 4.0 to 5.1 microns (2500 to 4000 B.P.) indicating Middle Archaic occupation (Figure 17), the majority of the hydration readings dated to the Upper Archaic and Emergent periods (post 2500 B.P.).



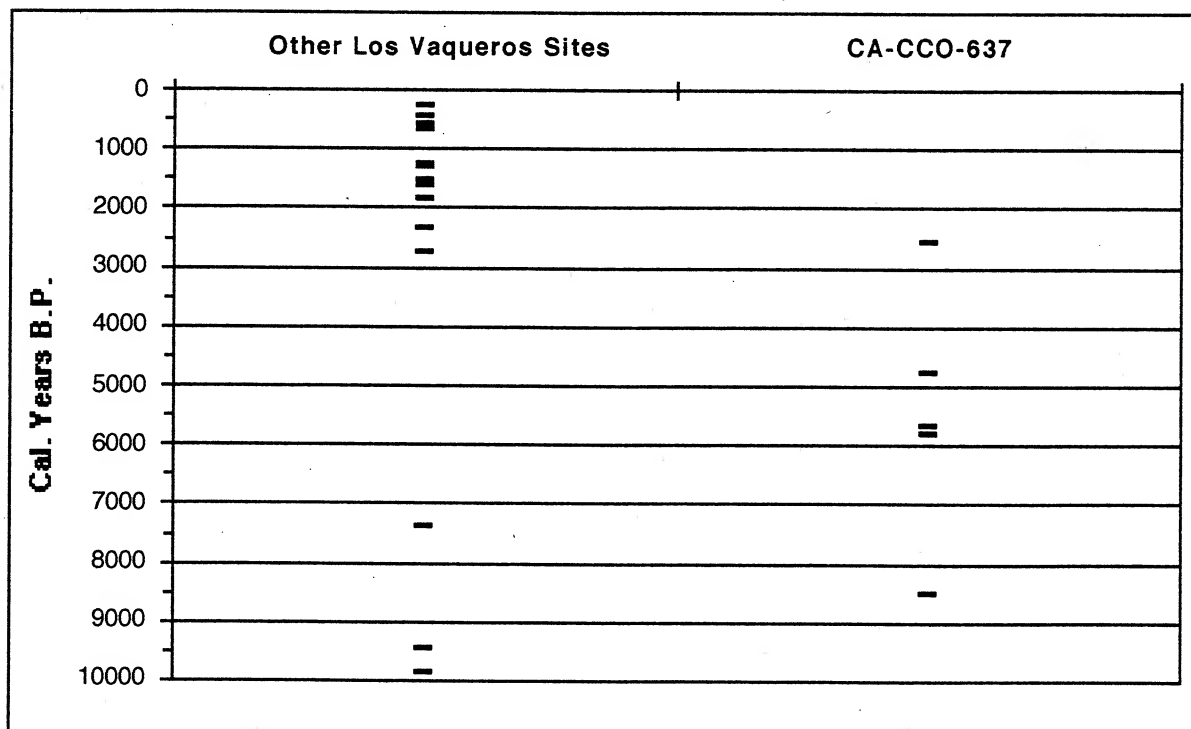
**Figure 14A.** Sex and Minimum Age of Human Remains from CCO-637



**Figure 14B.** Frequency of Burials at CCO-637 According to Position and Cultural Component



**Figure 15.** Orientation of Burials at CCO-637 According to Cultural Component



**Figure 16.** Radiocarbon Dates from Los Vaqueros Sites as Compared to Dates from CCO-637

## SETTLEMENT AND SUBSISTENCE

The occurrence of intact features, burials, and broad horizons of debris (i.e., fire-affected rocks, flaked stone, etc.) at two different depths within the alluvial fan deposit suggest that at least two occupational strata were represented at the site. While the features and burials are consistent with extended occupation, the different occupational strata indicate that the materials accumulated as a result of repeated occupations, and not as a result of a single occupation or prolonged settlement at the site.

The occurrence of mortars, pestles, and many large cobble-core tools and battered cobbles indicate that a variety of processing activities were conducted at the site. Archaeobotanical analysis indicates that upland species, such as manzanita and gray pine dominate the plant assemblage, although acorn, wild cucumber, and a few small seeds are also present (Wohlgemuth 1997). In contrast, the faunal assemblage suggests an emphasis on lowland species, including large (artiodactyls) and medium-sized (carnivores) mammals (Taite 1997). It appears that the dart and atlatl were the primary hunting implements given the occurrence at the site of a few dart-sized, side-notched projectile points. The remains of small freshwater minnows (Quinn 1997), and a charmstone that may have served as a net-weight or line-sinker, were also recovered from the site. These findings suggest that a variety of environmental zones were being exploited for purposes of subsistence.

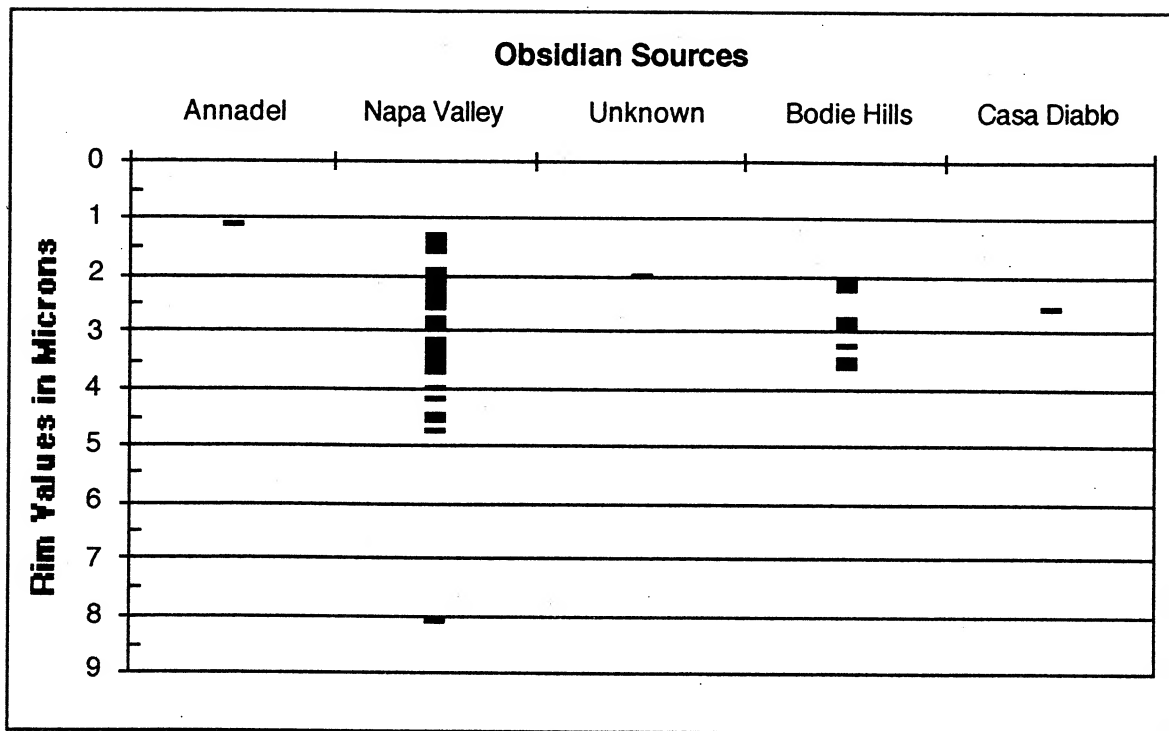
Taken together, the sparse, but functionally varied, artifact and feature assemblages combined with the diverse floral and faunal remains are consistent with residential-use of the site. Although the apparent paucity of small seeds in the floral assemblage points to a seasonal use of the site during the summer and fall, a high number of small seeds were found in the spillway feature sample, suggesting that the site may have also been used during the spring months (see Appendix B).

## INTERACTION AND EXCHANGE

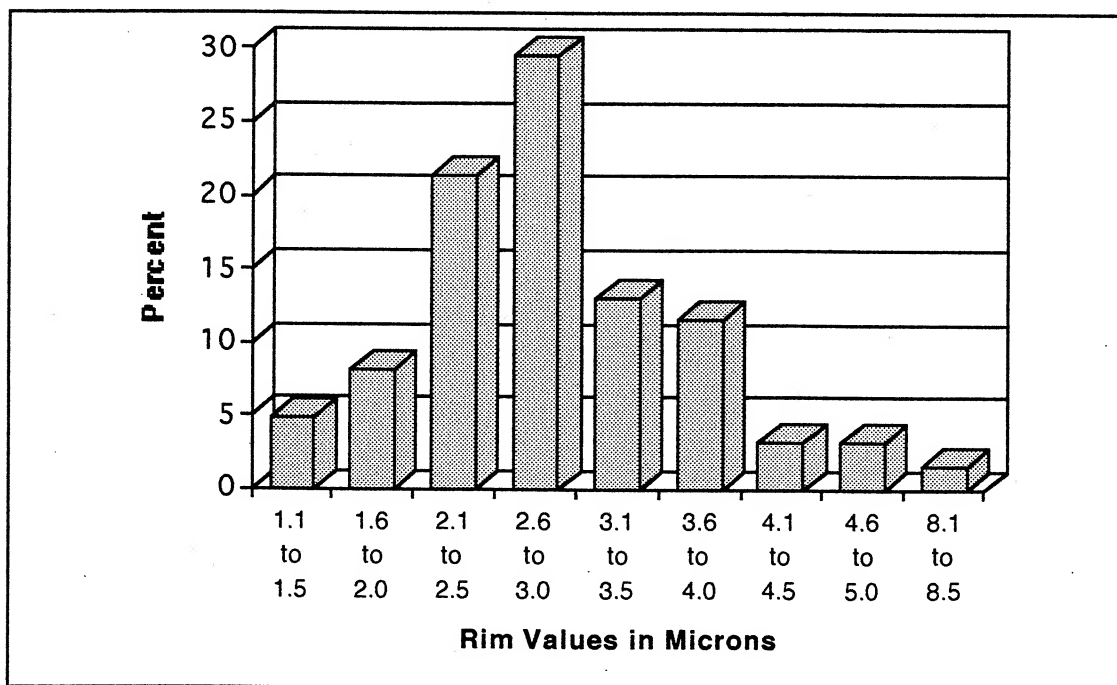
Certain nonlocal materials from the site (particularly obsidian and marine shell) provide evidence for interaction and/or exchange networks among prehistoric people. As such, the relative amount of nonlocal materials from CCO-637 can be interpreted as a reflection of the occurrence, timing, and stability of prehistoric interaction-exchange.

The occurrence of Napa Valley obsidian from the source in Napa County indicates that materials originating many miles from the Los Vaqueros area were already being acquired during the Middle Archaic period. This pattern of nonlocal obsidian acquisition appears to have continued through the Upper Archaic period. The appearance of Annadel, Bodie Hills, and Casa Diablo obsidian and increases in the amount of Napa obsidian during the Upper Archaic and Emergent periods alternatively suggests that: (1) the previous system of exchange was abandoned; (2) people with a pre-established tie to a North Coast ranges exchange system began to use CCO-637; (3) the existing exchange system underwent an expansion that resulted in more selection and reliability of the supply of obsidian; and/or (4) all the above.

Marine-shell beads from CCO-637 are another item thought to represent interaction-exchange. More than 1,000 *Olivella* shell beads were found in association with Burial 14 at the site. A radiocarbon date of 4770 B.P. from this burial indicates that materials originating from the Pacific coast were acquired as early as the lower Middle Archaic period. The beads from this burial were found in patterned arrangements, suggestive of decorated clothing (Figure 7A). Although marine-shell beads were absent from the other burials at CCO-637, high frequencies of these beads were found associated with burials dating to the lower Upper Archaic period at site CA-CCO-696, a short-distance upstream from CCO-637. The large quantity and uniformity of beads dating to the



**Figure 17A.** Frequency of Obsidian Hydration Rim Values from CCO-637 by Source.



**Figure 17B.** Percentage of Obsidian Hydration Rim Values from CCO-637. Grouped by increments of 0.5 microns.

Upper Archaic from CCO-696 suggest that they were systematically manufactured and acquired through an established exchange network, and may have served as items of fixed value.

While there are similarities among the patterns of obsidian and marine-shell exchange, there are indications that the exchange networks that supplied these items operated independently of each other. At CCO-637, the quantity of marine-shell beads appears to have reached its peak during the lower Middle Archaic and declined through the upper Middle Archaic. This was followed by an increase in the variety and frequency of obsidian during the Upper Archaic and Emergent period transition. These patterns are generally consistent with the findings from neighboring areas, where declining shell-bead quantities and increasing obsidian frequencies are found to have occurred during the latter part of the Upper Archaic period (Bieling 1996, Fredrickson 1969; Jackson 1974; Milliken and Bennyhoff 1993; and Wiberg 1988, 1996).

## **SUMMARY**

Archaeological investigations at CCO-637 have revealed a surprisingly long and complex record of human occupation that spans more than 8,500 years. The radiocarbon date (8530 B.P.) from Burial 21 confirms the presence of a Lower Archaic period component at the site, and is the earliest date associated with human remains reported in the San Francisco Bay-Delta region. This Lower Archaic component is the second such component identified in the upper Kellogg Creek drainage near the Los Vaqueros dam (the other is at site CCO-696). The antiquity of this site distinguishes it as one of the few examples of early Holocene human occupation identified in the region.

Five radiocarbon dates from the site demonstrate that a significant Middle Archaic component is also represented. These include one of the oldest dated shell-bead lots (4770 B.P.) in central California. The varied assemblage of artifacts, features, faunal and plant remains, and 23 human burials associated with this component suggest that the site was used as a semi-permanent residential base. These findings provide the most compelling and complete evidence for Middle Archaic human occupation yet identified in the Los Vaqueros area. In addition, obsidian hydration readings indicate that the site continued to be used (at least periodically) by people during the Upper Archaic and Emergent periods.

Despite expectations that the Los Vaqueros area would have been a marginal environment for human occupation before the Emergent period (1,000 years ago), the findings from CCO-637 indicate that at least one semi-permanent residential site was already established along this portion of upper Kellogg Creek more than 2,500 years ago. In addition, the geoarchaeological investigations of the site also contributed to a growing understanding of how Holocene landscape evolution has influenced the nature and apparent completeness of the regional archaeological record.

## **RECOMMENDATIONS**

### **FUTURE RESEARCH DIRECTIONS**

The prehistoric archaeological investigations at CCO-637 have added significantly to our understanding of the timing and nature of human land use in the interior Diablo range. Previous geoarchaeological investigations revealed that the visibility and preservation of archaeological deposits at the site were profoundly influenced by the processes of Holocene landscape evolution. This fact was demonstrated by the discovery of a previously unknown, deeply buried Lower Archaic period component at the site.

Because this component represents one of the few known examples of early Holocene human occupation in the region, future investigations should attempt to evaluate the age, nature, and extent

of this buried component. Previous archaeological and archaeobotanical investigations indicate that CCO-637 probably served as a residential base from which upland resources were exploited during the Middle Archaic period. Future research may also help to clarify the causal mechanisms and ecological implications of environmental change and the influence of these changes on prehistoric human settlement and subsistence at CCO-637.

#### **FUTURE TREATMENT**

Despite extensive earth-moving and construction, portions of CCO-637 remain relatively undisturbed and may contain significant deposits of archaeological materials, including human remains. As such, the site appears to have the potential to yield information that is very important for understanding little known periods of California prehistory. Plans for future treatment of the site should anticipate the possibility of encountering human remains and other significant archaeological deposits whenever additional earth-moving activities are planned or conducted within the undisturbed areas. For these reasons, the following measures are recommended for the future protection and treatment of the site, which may include but not necessarily be limited to:

- An archaeological research design should be developed that addresses the specific scientific value(s) and research potential of CA-CCO-637;
- A sensitivity map should be developed that accurately depicts the disturbed and undisturbed portions at CCO-637. This map should be based on available information derived from both archaeological and construction sources, and used to direct future construction activities and archaeological investigations at the site;
- The sensitivity map and research design should be integrated into the long-term cultural resources management plan being developed by Brady and Associates, Inc., (1996, 1997) as part of the *Los Vaqueros: Watershed Management Program*; and
- Due to the possibility that large or sustained spillway overflows may erode portions of the site within the earthen spillway canal, it is recommended that the site be inspected, either by an archaeologist or the assigned cultural resources coordinator, for signs of erosion following each such event. This recommendation should also be made part of the long-term cultural resources management plan.



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**APPENDIX A**  
**OBSIDIAN HYDRATION ANALYSIS**

## **APPENDIX A**

### **Obsidian Hydration Analysis Procedures and Results**

**Thomas M. Origer**

Described below are the procedures used to prepare thin sections and make hydration band measurements.

Each specimen was examined to find two or more surfaces that would yield edges that would be perpendicular to the microslide when preparation of the thin section was completed. Saw cuts were made at an appropriate location along the edge of each specimen with a 4-inch diameter circular saw blade mounted on a lapidary trimsaw. The cuts resulted in the isolation of a small sample with a thickness of approximately one millimeter. Each sample was removed from its specimen and mounted with Lakeside Cement onto a permanently etched petrographic microslide.

The thickness of the samples was reduced by manual grinding with a slurry of #500 silicon carbide abrasive on a glass plate. The grinding was completed in two steps. The first grinding was stopped when the sample's thickness was reduced by approximately one-half, thus eliminating any micro-chips created by the saw blade. The slides were reheated, which liquefied the Lakeside Cement, and the samples inverted and then ground until the proper thickness was attained.

The correct thin section thickness was determined by the "touch" technique. A finger was rubbed across the slide, onto the sample, and the difference (sample thickness) was "felt." A coverslip was affixed over the thin sections when all grinding was completed. The microslides are curated at the SSU Hydration Lab under File Nos. 93-H1390, 96-H1507 & -1508, 96-H1518, 96-H1544, 96-H1570, and 97-H1682 so that they are available to other researchers for future study.

The hydration bands were measured with a strainfree 60 power objective and a Bausch and Lomb 12.5 power filar micrometer eyepiece on a Nikon petrographic microscope. Six measurements were taken at separate locations along each thin section's edge. The mean of the measurements was calculated and it was listed, along with other pertinent information, on data tables. The hydration band measurements have a range of  $\pm 0.2$  due to normal limitations of the equipment.

The abbreviations A, BH, BL, CD and NV listed under the "Source" column on the following pages stand for the Annadel, Bodie Hills, Borax Lake, Casa Diablo and Napa Valley sources, respectively. These source abbreviations are followed by a "v" in the parentheses that indicates that their source assignment was made based on visual analysis.

## CCO-637 OBSIDIAN HYDRATION RESULTS

ACC #	CAT #	SUB CAT #	ARTIFACT	COUNT	UNIT	DEPTH	CONTEXT	SOURCE	METHOD	LAB #	HYD. LAB	BAND 1
95-7	121	B	FLAKE	1	S27/W3	120-130	-	AN	XRF	7	96-H1518	1.1
95-7	71	A	FLAKE	1	-	-	-	NV	VISUAL	1	94-H1390	1.3
95-7	332	V	FLAKE	1	TR4-27-1	060-080	16-20M	NV	XRF	17	95-H1390	1.4
95-7	193		FLAKE	1	S31/W3	080-090	-	NV	VISUAL	6	96-H1507	1.5
95-7	202		FLAKE	1	S31/W3	090-100	-	NV	VISUAL	7	96-H1507	1.6
95-7	300	II	FLAKE	1	TR4-27-1	060-080	4-8M	NV	XRF	11	95-H1390	1.6
95-7	220	E	FLAKE	1	S31/W3	120-130	-	NV	XRF	22	96-H1518	1.9
95-7	332	W	FLAKE	1	TR4-27-1	060-080	16-20M	NV	VISUAL	18	95-H1390	2.0
95-7	444	CM-18	FLAKE	1	SPILLWAY	140-160	FEATURE	UNKNOWN	VISUAL	1	97-H1682	2.0
95-7	20	C	FLAKE	1	S20/W0	060-080	-	BH	VISUAL	3	94-H1390	2.1
95-7	80		FLAKE	1	S27/W3	070-080	-	NV	XRF	2	96-H1518	2.1
95-7	82		FLAKE	1	S27/W3	070-080	-	NV	XRF	3	96-H1518	2.2
95-7	118	A	FLAKE	1	S27/W3	090-100	-	NV	XRF	4	96-H1518	2.2
95-7	212		FLAKE	1	S31/W3	110-120	-	BH	XRF	18	96-H1518	2.2
95-7	220	F	FLAKE	1	S31/W3	120-130	-	NV	VISUAL	9	96-H1507	2.2
95-7	269	B	FLAKE	1	S33/W3	110-120	-	NV	XRF	13	96-H1518	2.2
95-7	248		FLAKE	1	S31/W3	130-140	-	NV	XRF	23	96-H1518	2.3
95-7	258		FLAKE	1	S33/W3	100-110	-	NV	XRF	11	96-H1518	2.3
95-7	269	A	FLAKE	1	S33/W3	110-120	-	NV	XRF	12	96-H1518	2.3
95-7	220	B	FLAKE	1	S31/W3	120-130	-	NV	VISUAL	8	96-H1507	2.4
95-7	341	AA	FLAKE	1	TR4-27-1	060-080	20-24M	NV	VISUAL	22	95-H1390	2.4
95-7	230	B	FLAKE	1	S33/W3	090-100	-	NV	XRF	10	96-H1518	2.5
95-7	121	A	FLAKE	1	S27/W3	120-130	-	NV	XRF	6	96-H1518	2.6
95-7	118	B	FLAKE	1	S27/W3	090-100	-	CD	XRF	5	96-H1518	2.6
95-7	220	C	FLAKE	1	S31/W3	120-130	-	NV	XRF	20	96-H1518	2.6
95-7	139		FLAKE	1	S27/W3	140-150	-	NV	XRF	8	96-H1518	2.7
95-7	303	CC	FLAKE	1	TR4-27-1	060-080	8-12M	BH	XRF	13	95-H1390	2.7
95-7	341	Y	FLAKE	1	TR4-27-1	060-080	20-24M	NV	VISUAL	20	95-H1390	2.7
95-7	348	GG	BIFACE	1	TR4-27-1	060-080	28-32M	NV	XRF	24	95-H1390	2.7
95-7	81		BIFACE	1	S27/W3	070-080	-	NV	XRF	1	96-H1518	2.8
95-7	105		FLAKE	1	S27/W3	100-110	-	BH	VISUAL	1	96-H1507	2.8
95-7	186		FLAKE	1	S31/W3	070-080	-	BH	VISUAL	5	96-H1507	2.8
95-7	148	A	FLAKE	1	S29/W3	070-080	-	BH	XRF	15	96-H1518	2.9
95-7	341	BB	FLAKE	1	TR4-27-1	060-080	20-24M	NV	VISUAL	23	95-H1390	2.9
95-7	427	CM-1	PROJECTILE	1	BASIN	-	BACKDIRT	NV	VISUAL	1	96-H1570	2.9
95-7	115		FLAKE	1	S27/W3	110-120	-	NV	VISUAL	2	96-H1507	3.0
95-7	174		FLAKE	1	S29/W3	090-100	-	NV	VISUAL	4	96-H1507	3.0
95-7	274	B	FLAKE	1	S33/W3	120-130	-	NV	VISUAL	12	96-H1507	3.0
95-7	400	B	PROJECTILE	1	-	102-102	BUR-7	NV	VISUAL	36	96-H1544	3.0
95-7	417	C	BIFACE	1	-	102-102	BUR-7	NV	VISUAL	34	96-H1544	3.0
95-7	332	X	FLAKE	1	TR4-27-1	060-080	16-20M	NV	VISUAL	19	95-H1390	3.1
95-7	74	J	FLAKE	1	-	-	-	NV	VISUAL	9	94-H1390	3.2
95-7	183		FLAKE	1	S31/W3	055-070	-	BH	XRF	16	96-H1518	3.2
95-7	300	HH	FLAKE	1	TR4-27-1	060-080	4-8M	NV	XRF	10	95-H1390	3.2
95-7	220	D	FLAKE	1	S31/W3	120-130	-	NV	XRF	21	96-H1518	3.3
95-7	220	A	FLAKE	1	S31/W3	120-130	-	NV	XRF	19	96-H1518	3.4
95-7	324	FF	FLAKE	1	TR4-27-1	060-080	12-16M	NV	XRF	16	95-H1390	3.4
95-7	175		FLAKE	1	S31/W3	070-080	-	BH	XRF	17	96-H1518	3.5
95-7	192		BIFACE	1	S31/W3	080-090	-	NV	VISUAL	0	96-H1544	3.5
95-7	243		FLAKE	1	S33/W3	080-090	-	BH	XRF	9	96-H1518	3.5
95-7	20	D	FLAKE	1	S20/W0	060-080	-	NV	VISUAL	4	94-H1390	3.6
95-7	48	E	FLAKE	1	S10/W0	040-050	-	NV	VISUAL	5	94-H1390	3.6
95-7	72	B	FLAKE	1	-	-	-	BH	VISUAL	2	94-H1390	3.6
95-7	73	H	FLAKE	1	-	-	-	NV	VISUAL	8	94-H1390	3.6
95-7	41	F	FLAKE	1	S10/W0	030-040	-	NV	VISUAL	6	94-H1390	3.7
95-7	42	G	FLAKE	1	S10/W0	000-010	-	NV	VISUAL	7	94-H1390	3.7
95-7	324	EE	FLAKE	1	TR4-27-1	060-080	12-16M	NV	XRF	15	95-H1390	4.0
95-7	148	B	FLAKE	1	S29/W3	070-080	-	NV	VISUAL	3	96-H1507	4.2
95-7	274	A	FLAKE	1	S33/W3	120-130	-	NV	VISUAL	11	96-H1507	4.5
95-7	300	JJ	FLAKE	1	TR4-27-1	060-080	4-8M	NV	XRF	12	95-H1390	4.6
95-7	230	A	FLAKE	1	S33/W3	090-100	-	NV	VISUAL	10	96-H1507	4.7
95-7	422		FLAKE	1	-	190-190	BUR-6	NV	VISUAL	35	96-H1544	8.1
95-7	324	DD	FLAKE	1	TR4-27-1	060-080	12-16M	NV	XRF	14	95-H1390	DH
95-7	341	Z	FLAKE	1	TR4-27-1	060-080	20-24M	NV	XRF	21	95-H1390	DH
95-7	395		PROJECTILE	1	-	-	-	AN	VISUAL	33	96-H1544	NVB
95-7	269	C	FLAKE	1	S33/W3	110-120	-	NV	XRF	14	96-H1518	VW

**APPENDIX B**  
**ARCHAEOBOTANICAL ANALYSIS**



# **ARCHAEOBOTANICAL INVESTIGATION OF THE SPILLWAY OUTLET FEATURE AT CA-CCO-637**

Eric Wohlgemuth

A 15.1 liter soil sample was collected from a feature deposit at the Los Vaqueros Reservoir spillway outlet at archaeological site CCO-637. This sample was subjected to the same program of water flotation and analysis for the Los Vaqueros project described in Wohlgemuth (1997), with one major exception. Because of the dearth of recovered charred light fraction (only 2.5 grams total), rather than examining only material larger than 0.7 mm (24/inch mesh, the project standard), the entire sample contents (to 0.4 mm [40/inch mesh]) were analyzed. This size grade of materials was examined in the larger Los Vaqueros project only for the Early Holocene component at site CCO-696 West. To ensure comparability with previous samples analyzed from CCO-637, the spillway feature light fraction was size sorted using an 0.7 mm screen, along with an 0.5 mm screen.

Because this is a departure from all but the CCO-696 West materials, findings from this last sample from CCO-637 are presented separately for the three size grades in Table 1 below:

**Table 1.** Raw Counts of Seed Remains from the Spillway Feature Sample, CCO-637.

	<i>0.7 mm grade</i>	<i>0.5 mm grade</i>	<i>0.4 mm grade</i>
<u>Nutshell and Berry Pits</u>			
Acorn			
#	3	2	10
mg	0.9	0.2	0.5
Buckeye			
#	--	1	2
mg	--	0.2	0.2
Manzanita			
#	--	1	2
mg	--	0.2	0.1
Total	3	4	14
	0.9	0.6	0.8
<u>Small Seeds</u>			
Red maids/miners lettuce	--	7	96*
Grass caryopsis fragments	--	2	--
Unidentified seeds	1	--	--
Unidentified seed fragments	--	--	1
Total seeds	1	9	97

\* Seed coat fragments; no minimum number of individuals estimated.

How does the spillway feature sample compare to previous findings at CCO-637? Prior analysis of ten flotation samples from CCO-637 revealed a robust nut and berry assemblage accompanied by a very sparse set of small seeds. Six nut and berry taxa were found in at least 7 of the 10 samples. CCO-637 differed from all other sites investigated in the Los Vaqueros project in

the high frequency of nutshell of gray pine (*Pinus sabiniana*), a taxon found only at considerable distance (at least 10 miles) from the project area (Wohlgemuth 1997).

Evaluation of the present vs. previous CCO-637 samples depends to some extent on which size grade is considered for the present sample. If, following previous work, only the 0.7 mm grade is examined, then the absence of all nut and berry residues except acorn (*Quercus* sp.) nutshell is strikingly different from the prior results. The small seed assemblage is essentially nonexistent, but this is not inconsistent with the earlier work. If the 0.5 mm grade is added, then buckeye (*Aesculus californica*) and manzanita (*Arctostaphylos* sp.) are present, again consistent with the prior findings, where they were encountered in 7 and 10 of the 10 total samples analyzed, respectively. Several seed coat fragments of either red maids (*Calandrinia* sp.) or miners lettuce (*Claytonia* sp.) were found in the 0.5 mm grade, along with two grass (Poaceae) caryopsis fragments. The former were not reported from the prior work, while the latter were found in small numbers in 6 of the 10 analyzed samples. When the 0.5 mm material is also considered with the 0.7 mm grade, the present sample is still distinctive from the prior samples.

Finally, when the 0.4 mm grade material is considered, additional fragments of acorn, buckeye, and manzanita are added, however, the most conspicuous addition is the high number (96) of red maids/miners lettuce seed coat fragments. Miners lettuce was absent from the earlier samples, while red maids seed was found in two samples. While I believe that most of the seed coat fragments are from red maids rather than miners lettuce seeds, the finding of so many is certainly a departure from the prior samples.

The archaeobotanical contents of the spillway feature from CCO-637 differ from those of previously analyzed contexts, in some cases regardless of size grade considerations. While acorn, buckeye, and manzanita residues are present in low numbers, other ubiquitous large taxa (gray pine, wild cucumber [*Marah* sp.], and bay nut [*Umbellularia californica*]) are absent. On the other hand, the size grade analyzed is critical in assessing the similarity or difference of small seed assemblages. At the 0.7 mm grade, and even the 0.5 mm grade, small seeds are as sparse or even more rare than in the prior samples. At the 0.4 mm level, however, there are large numbers of red maids/miners lettuce seed coat fragments. While this finding is not anticipated at all by previous work at CCO-637, no 0.4 mm grade was examined before.

In sum, the spillway feature contains a distinctive archaeobotanical signature as compared to other identified samples from CCO-637. How much of this distinction is based on the limits of prior analysis by size sorting is unknown; this issue remains to be sorted out. Examination of size grades smaller than 0.7 mm appears warranted, not only for CCO-637, but probably for all other sites in the Los Vaqueros project (Wohlgemuth 1997), and for central California sites in general, particularly those from older components (Wohlgemuth 1996).

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**APPENDIX C**  
**HUMAN REMAINS**

# HUMAN REMAINS

Lori D. Hager, Ph.D.

## INTRODUCTION

All human remains recovered from CCO-637 were analyzed by Dr. Lori Hager of Hager/Holson and Associates, or by ASC personnel under Dr. Hager's supervision. A volume containing the skeletal inventory, osteometric data, and nonmetric observations recorded for each burial will be filed at the Northwest Information Center of the California Historical Resources Information System, Sonoma State University. All the human remains and associated artifacts were reburied within the Reservoir area on November 1, 1997, under the supervision of Native American Most Likely Descendant, Andrew Galvan (see Appendix E).

## METHODS

Below are the criteria used in the field and laboratory to make such determinations as flexure and orientation of burials, artifact association, age and sex of individuals, as well as the measurements and observations made to identify pathologies and other anomalies.

### DESCRIPTIVE FIELD CRITERIA

#### Flexure and Orientation

Burial flexure was defined in the field based on the angle between the femur and the torso and the femur and the tibia. Four degrees of flexure were defined: tight flex, loose flex, semi-extended, and extended. When the angle between the midline of the torso and the distal femur was between 0 and 60 degrees, the burial was considered to be a tight-flex; when the angle was between 61 and 120 degrees, it was considered a loose flex; when between 121 and 180 degrees, it was considered extended. When describing extended burials, the angle between the proximal femur and the distal tibia was also considered; when that angle was between 0 and 90 degrees, it was considered semi-extended; when it was between 91 and 180 degrees, it was considered extended.

Burial orientation was determined in the field by taking bearings along a line between the center of the torso and the top of the cranium; bearings were taken with reference to magnetic north. When the burial was heavily deteriorated, orientation was estimated based on the alignment of the vertebral column or other in situ elements. In several instances, burials were so heavily disturbed that no orientation or position could be determined.

In the laboratory, burial flexure and position were determined by examining field notes, in situ illustrations, and photographs. Burial position is described as either left side, right side, ventral (on stomach), or dorsal (on back).

#### Artifact Association

Archaeological material considered to represent general habitation debris, such as stone flaking debris and burnt and unburnt mammal-bone fragments, was regularly found within burial matrices. Particularly at CCO-458 and CCO-696, there was substantial evidence of burial disturbance either from aboriginal activities or through natural means (bioturbation or pedoturbation). Rather than considering this material to be intentional grave offerings, we assumed that habitation debris found in burial matrices was introduced, either through burial-pit backfill or some other natural or mechanical process. For the purposes of analysis, only *formal* artifacts (e.g., shell beads, ornaments, projectile points) found in proximity (less than 15 cm) to burials were considered to be direct associations. In a few cases, unusual faunal material (e.g., bear, eagle), commingled with the skeleton, was also determined to be associated.

### LABORATORY METHODS

The condition of the burials ranged from good to very poor. Many of the burials were highly fragmented due to prehistoric disturbance, other natural postdepositional processes, and/or the use of heavy equipment at the site. In addition, once the burials were exposed, many of the bones became unstable. Due to the fragile nature of some of these exposed bones, in certain instances the identification of elements relied on field observations. Thus, whenever bony elements were too fragmentary to identify in the lab, we recorded the field identification of the elements in the inventory.

In the laboratory, all the bones were washed, sorted by element and side, and inventoried. Once inventoried, each burial was then examined for a determination of age, sex, and overall health of the individual at the time of death. Cranial, dental, and postcranial metric measurements were then taken whenever the bones were complete enough to measure. Nonmetric traits were scored for the cranium. All burials were checked by Dr. Hager before being reboxed for reburial.

### **Age Determination Criteria**

Age was determined using as many criteria as available, always giving greater weight to the more reliable age determinants. Patterns of dental eruption (Gustafson and Koch 1974; Ubelaker 1989) and epiphyseal unions (McKern and Stewart 1957; Human Identification Laboratory, Arizona State Museum; Krogman and Iscan 1986) were given the greatest weight, especially for the subadult and early adult material. Subadult age determinations were also made based on long-bone lengths (Johnston 1962; Ubelaker 1989). For the adults, characteristics of the symphyseal face of the pubis (McKern and Stewart 1957, as cited in White 1986; Todd 1920) were given higher rank over patterns of dental attrition (Lovejoy 1985) and cranial suture closure. Aging by dental attrition, however, was particularly useful on those individuals in the adolescent and early adult phases. In addition, in the absence of a pubic symphyseal face (which is often the case), the pattern of dental attrition for an individual was given greater weight as a relative age marker.

For many burials, only fragments of the cranium were available for use in age determination. In these instances, we relied on endo- and ectocranial suture closure to make age assessments even though the variability in suture closure among modern humans may be great. Thus while cranial suture closure was used more cautiously than the other aging criteria, we nonetheless used this method of age determination in the absence of other markers. Finally, we examined the sternal end of the ribs for deterioration characteristic of certain ages as outlined in (Iscan et al. 1985). This latter technique did not prove very consistent and was only used when no other age markers were available.

### **Sex Determination**

The criteria for determining sex were also ranked. Due to their high predictive value in assessing sex, pelvic traits were given the highest priority based on criteria outlined in Hager (1989,1996) These included the discriminatory features of the greater sciatic notch, the superior pubic ramus, and the pubic body.

Cranial and mandibular traits were also used to determine sex, following Bass (1971) and Krogman and Iscan (1986). The supraorbital region, the mastoids, and the external occipital protuberance were most common cranial features available for sex determination in this sample. On the mandible, the gonial angle and the symphyseal region were the best preserved for analysis.

Overall robusticity was a relatively low-ranking criterion for sex determination when it became clear early in the analysis that body size showed overlap between the sexes. That is, when sex was determined by criteria other than size in this sample, such as by the pelvis, some females were large and robust and some males were small and gracile. Nonetheless, when body size was the only way to determine sex, those individuals that were clearly large and rugged were assigned to the "possible male" category, and those who were clearly small and gracile were assigned to the "possible female" category, with the notation that this assessment was based on body size only.

Due to the fragmentary nature of the sample in general, sex was indeterminate for a large number of these burials. For some individuals, when the determination of sex was based on low-ranking criteria (such as robusticity outlined above), sex was assigned as "possible" male or female. A "probable male" or "probable female" assignment means that multiple criteria were available for sex determination but that the available criteria were not strong enough to be 95% certain that the skeleton was one sex and not the other.

Sex determination was not attempted for the subadult material due to the lack of reliable sex markers in this age group.

### **Pathologies**

The bones were also examined for any anomalies or pathologies to determine the overall health of the individual at the time of death. In most instances, this was a macroscopic examination of the gross morphology of the bone. Occasionally, bones were examined using a stereomicroscope (ranging in magnification from 10X to 40X) to determine if there had been microscopic changes in the cortical bone or in the dentition. Assessments of the various pathological conditions follow diagnoses outlined in Huss-Ashmore et al. (1982); Ortner and Putschar (1985); Rose et al. (1985); Sarnat and Schour (1941); and White (1986).

### **Metric Measurements**

Cranial, dental, and postcranial measurements were attempted on the more complete bones using digital, spreading and coordinate calipers, while long bones were measured using an osteometric board. All measurements were recorded in millimeters.

Although no crania were complete enough to warrant full measurement in this sample, measurements were sometimes attempted on fragmentary remains. .

As often happens, the dentition was better preserved than the crania, and at least some dentition was available for analysis for a few individuals. Mesio-distal and buccal-lingual lengths were taken using the digital calipers. Only those teeth with sufficient crown present were measured.

Postcranial measurements were limited due to the incompleteness of the long bones. For the appendicular skeleton, midshaft measurements were taken more frequently than were the total lengths or the dimensions of the articular surfaces. For the axial skeleton, only a few measurements of clavicle dimensions were possible. Estimates of stature could be not calculated according to the regression formulae given by Trotter and Gleser (1952, 1958) and Trotter (1970), due to the lack of measurable long bone lengths.

Measurements that could be recorded are presented on page C-10 of this appendix.

### **Nonmetrics**

It was not possible to score nonmetric cranial traits as being present or absent due to the incompleteness of the crania in the sample. Likewise, no postcranial nonmetrics were noted.

## **BURIAL DESCRIPTIONS**

### **Burial 19**

This individual was an adult of moderate robusticity. The bone preservation was fair although the elements were highly fragmented. Caliche was well formed on nearly all the bones, making surface examination difficult. Most parts of the skeleton were available for study although the axial skeleton was poorly represented and only a few hand bones were recovered. The long bones had both proximal and distal ends available but none of these bones were complete.

The long bones showed complete epiphyseal union, indicating an adult status for this individual. The teeth also demonstrated complete eruption. All but the M3's were highly worn, with the dentine showing and little crown remaining. The M3's, on the other hand, exhibited moderate polishing on the intact crowns. This pattern of dental attrition suggests the individual was on the younger side of adulthood, perhaps 25-30 years of age. No other aging criteria were available.

Sex was indeterminate. The pelvis was missing and the cranium was fragmentary. The mandible was also missing. On the cranium, the supraorbitals showed slight to moderate development and the cranial bones were of moderate thickness. Neither of these traits adequately indicates male or female. The postcranial skeleton was moderately robust. A femoral head diameter of 47.09 cm suggests an individual of medium build, possibly male.

One tooth (maxillary I2) showed light enamel hypoplasia in the form of two transverse grooves on the labial surface. Other than high dental attrition, no other pathologies were noted.

A few dental and postcranial measurements were possible. Nonmetrics of the cranium were not possible to score.

An unidentified freshwater shell and groundstone fragment were found near this burial.

### **Burial 20**

This incomplete burial represents the remains of adult. This was probably a male. Many skeletal elements were missing. The cranium was incomplete and highly fragmented. Part of maxillary alveolus was present with 3 teeth in place. The mandible was absent. A few fragments of the axial skeleton were recovered but very little of the appendicular skeleton was available for study. The bones present were in fair condition.

Few aging indicators were available for assessment. Based on the high dental attrition, the complete resorption of the alveolus at the maxillary right I1, and the partial alveolar resorption at the right I2, this individual was probably an adult over 35 years.

This individual was determined to be a "probable" male based on the overall robusticity of the skeleton. The supraorbital torus was well-developed, the mastoid process large, and the cranial bones thick. The right radius, a proximal foot phalanx, and the acromial aspect of the right clavicle also exhibited a robustness, especially in muscular development, more typical of males than females.

The resorption of the alveolus in the right maxillary incisor area suggests tooth loss accompanied by periodontal disease in this region. Other than high dental attrition, no other pathologies were noted.

Metric and nonmetric assessments were not possible on the fragmentary remains of this individual.

### **Burial 21**

The individual represented by these remains was an adult of indeterminate sex. Although highly fragmented, nearly all skeletal elements were present. Overall, the bone preservation was fair. Most bones were encrusted with caliche. The cranium was highly fragmented. The maxilla and mandible were partially present with many of the teeth in their sockets (especially the maxillary dentition). The axial skeleton was more fragmentary than the appendicular skeleton. Some of the long bones were nearly complete, albeit in conjoining fragments. Many of the hand and feet bones were also present.

All the long bones were fused; the iliac crest was also fused. These complete epiphyseal fusions indicate that this individual was an adult. The complete eruption of the adult dentition was also suggestive of an adult. The dental wear pattern was moderate to high on all the teeth except the M3's. On these other teeth, even with some of the dentine exposed, there was a large amount of the crown still in place. On the M3's, dental wear was light to moderate without any dentine showing. This pattern is suggestive of an individual whose M3's have not been fully erupted for a long period of time. This individual may have been in its late 20s or early 30s. Examination of the cranial sutures for closure pattern was limited due to the caliche encrustation. The lambdoid suture appeared to be beginning closed minimally, indicating an age of 26-29 years of age. This age is consistent with the age based on dental wear.

Sex was indeterminate for this individual. The greater sciatic notch was too fragmentary to measure although the anterior portion looked narrow. The leg and arm bones are of moderate dimensions. No other sexing criteria were available.

Enamel hypoplasia characterized several of the teeth as 2 transverse grooves on the labial surface (maxillary right I1, left I2, right/left C; mandibular left I2, right/left C). These grooves were most pronounced on the maxillary right C and left I2. No other pathologies were noted.

No cranial measurements were taken. A few postcranial measurements were taken on the long bones. Nonmetric traits were not scored due to the fragmentary nature of the cranium.

A charcoal sample collected from the chest area of this burial produced a radiocarbon date of 7800 +/-50 B.P. or 8530 cal B.P. (Beta-108327).

In addition, a large subangular sandstone cobble was found resting on the left hand of the individual.

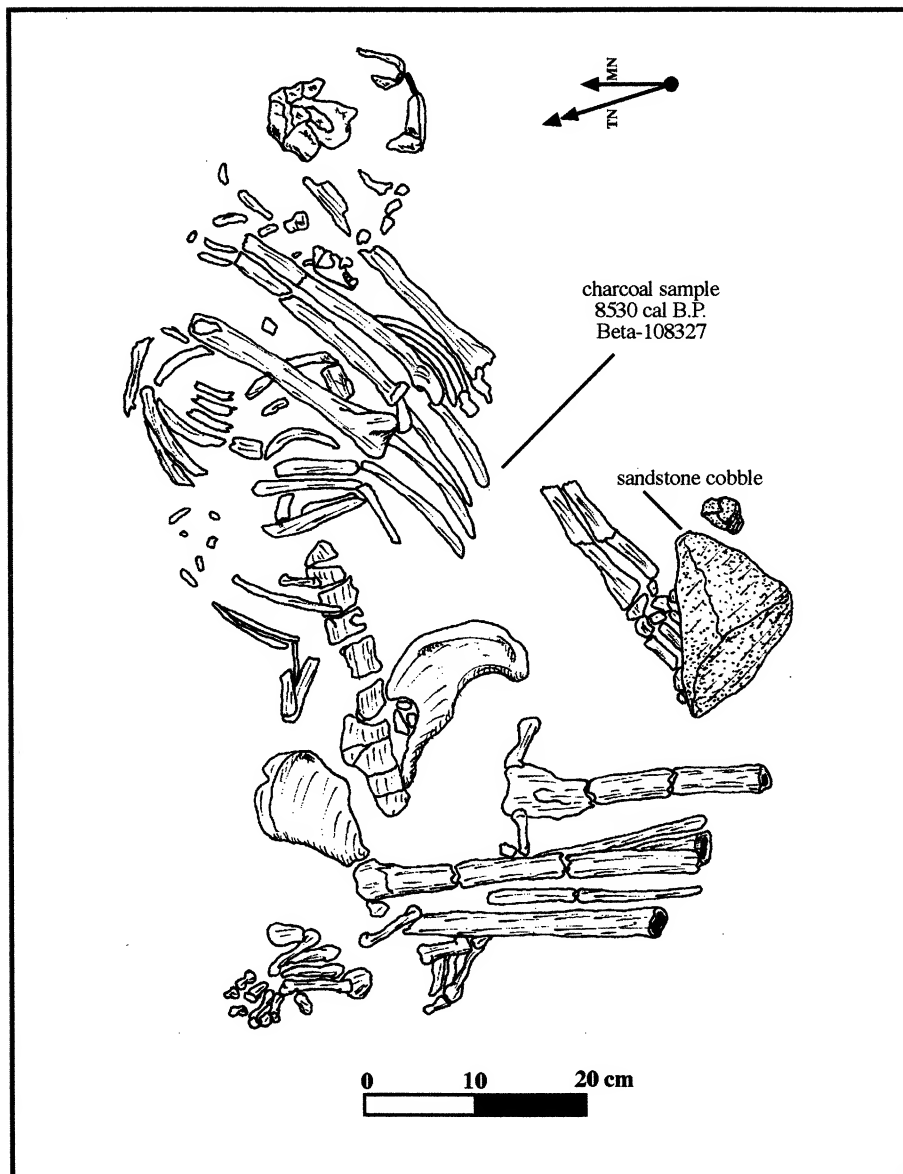
### **Burial 22**

This individual was an adult, aged 30+ years. Sex was determined to be probable male. Although highly fragmented, many skeletal elements were present. The overall condition of the bones was fair. The cranium was not intact even though many cranial bones were present. The maxilla was the only facial bone present. Several maxillary fragments of the alveolus were recovered with some of the teeth in their sockets. Other teeth were found loose. The mandible was partially present in several fragments; a number of mandibular teeth were found loose. With the exception of the pelvis which was absent, many fragmented elements of the axial skeleton were present. The arms were represented mainly by midshaft fragments of both sides. Only the right leg bones were recovered. A few metacarpals and metatarsals were found.

The complete fusion of the epiphyses was inferred to be complete based on the size of the bones but this age indicator was inconclusive. However, the individual demonstrated complete eruption of the adult dentition, suggesting this was an adult. The dental wear was extreme on all the teeth except for the left mandibular M2 and M3. These latter teeth showed differential dental wear with the proximal tooth exhibiting extreme dental wear and the distal tooth moderate wear. This unusual pattern of dental attrition suggests differential occlusion of the corresponding maxillary dentition and/or differential use of the proximal and distal occlusal surfaces of these mandibular teeth. Examination of the cranial sutures indicates at least beginning closure of the coronal, sagittal and lambdoid sutures. This is a pattern more typical of an adult over 30 years of age. This age is consistent with the pattern of dental wear displayed by this individual.

Features of the cranium and mandible are suggestive of this individual being a male. The supraorbital torus, mastoid, and external occipital protuberance are all well-developed and rugged. The gonial angle of the mandible is everted with strong muscle attachments evident on the bone. These are traits found more commonly in males than in females.





**Burial 21**

Resorption of the maxillary alveolus was apparent in the area of the left I1, possibly the left I2-C, and at the right P4 position. This resorption is suggestive of tooth loss accompanied by periodontal disease. No other pathologies were noted.

A few dental and postcranial measurements were taken. Nonmetric traits were not scored because the cranium was too fragmentary.

#### **Burial 23**

This incomplete burial was an adult. Sex was determined as "possible" male. The bones were in poor to fair condition. Most of the remains were of the appendicular skeleton. A few cranial vault bones and a few vertebral fragments are all that were found of the cranial and axial skeleton. A few lower arm and leg midshaft fragments are the main bones present for this burial.

Age could only be assessed as "probable" adult due to the incompleteness of the burial. The fusion of the epiphyses onto the diaphyses of the long bones was probably complete, thus suggesting an adult. No other age indicators were available.

The "possible" male sex determination is based on the overall robusticity of the ulnar, radial, and fibular midshafts. All of these bones exhibited well-defined muscle attachments. No other sexing criteria were available.

No pathologies were noted. No metric measurements were possible. Nonmetric traits could not be scored due to the absence of most of the cranium.

#### **Burial 24**

This individual was an adult of indeterminate sex. The burial was incomplete with the bones present in fair condition. The cranium was represented by several fragments of the cranial vault bones. No facial bones were recovered. One tooth (right mandibular canine) was found with this burial. No axial skeletal elements were found. The appendicular skeleton was represented by several fragments of the left humerus and right radius, and small midshaft fragments of all the lower limb bones except for the patella. No hand or feet bones were present.

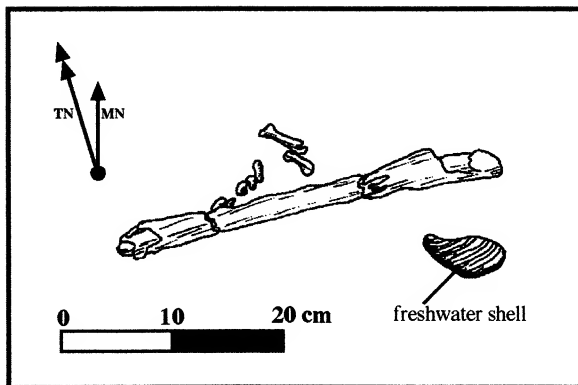
Age was assessed as adult based on the heavy dental wear on the one tooth and the pattern of cranial suture closure (at least beginning closed on the coronal, sagittal and lambdoid sutures). No other age indicators were available.

Sex was indeterminate due to the lack of any sexing criteria. The radial fragments suggested this was an individual of medium build, either male or female.

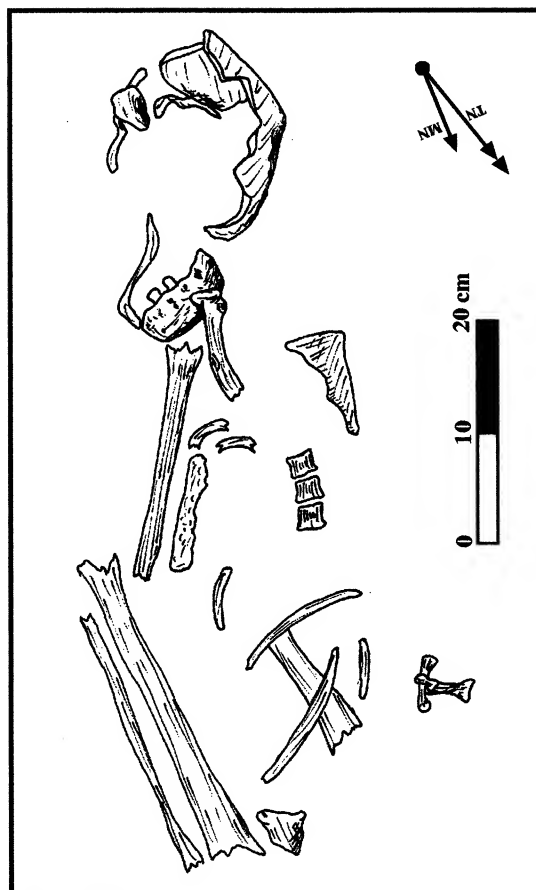
No pathologies were noted. No measurements were taken. Nonmetric traits could not be scored due to the fragmentary nature of the cranium.

#### **Burial 25**

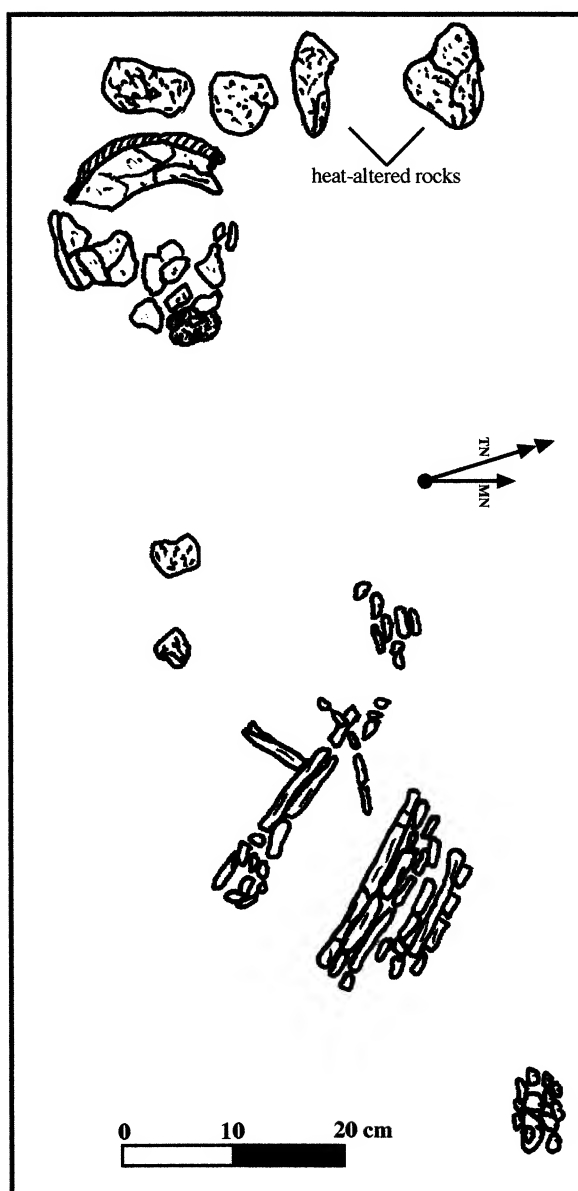
This incomplete burial was a probable adult of indeterminate sex. The bones were found in a highly fragmentary condition. Identified bones included fragments of the cranium, humerus, pelvis, and femur. Age could only be assessed as "probable" adult on the basis of fused sutures on one cranial fragment. No pathologies were noted. No metric measurements were possible. Nonmetric traits could not be scored due to the incompleteness of the cranium.



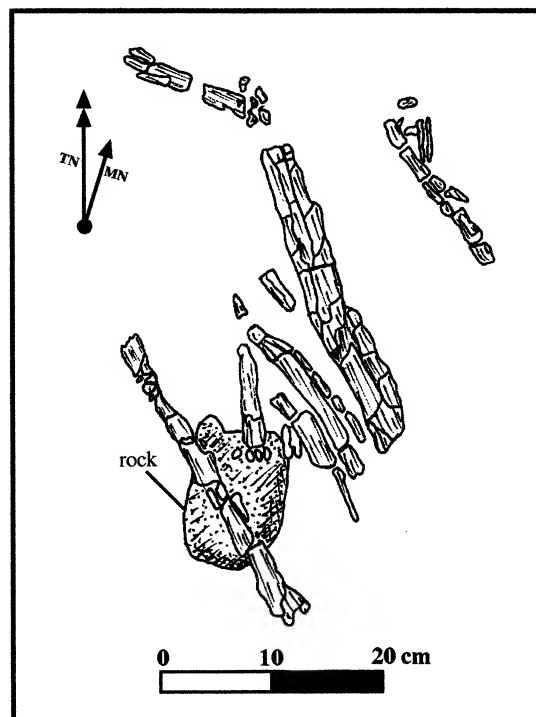
**Burial 19**



**Burial 22**



**Burial 24**



**Burial 23**

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# OSTEOLOGICAL METRICS

Burial 19: Measurement/Element	Mastoids	Maxilla M-D	Maxilla B-L	Mandible M-D	Mandible B-L	Clavicle	Humerus	Radius	Ulna	Femur	Tibia	Fibula	Patella
RM3		9.39	11.43	11.22	10.92								
RM2				11.17	11.02								
RM1				10.76	10.42								
RP4					8.48								
RP3					8.57								
Mid circumference-left							67						
Max-diam. mid-shaft-left							21.51						
Min-diam. mid-shaft-left							20.62						
Least circum. (distal to deltoid)-left							60						
Sagittal diam. mid-shaft (A-P)-left								13.61					
Transverse diam. mid-shaft (M-L)-left								12.64					
Max. hd. diam.-left										47.09			
Subtrochanteric (A-P) diam.-left										25.52			
Subtrochanteric (trans.) diam.-left										36.3			
Mid-shaft (A-P)-right											31.26		
Mid-shaft (trans.)-right											21.66		
Max.diam. at mid-shaft-right												16	
Burial 21: Measurement/Element	Mastoids	Maxilla M-D	Maxilla B-L	Mandible M-D	Mandible B-L	Clavicle	Humerus	Radius	Ulna	Femur	Tibia	Fibula	Patella
LM3		9.6	11.48										
LM2		9.22	12.01										
LM1		10.29	12.49										
LP3		7.48	9.37										
LC		8.43	5.21										
LI1		8.55		5.32	4.43								
RM2		8.28	11.43	13.15	11.11								
RP4		7.16	8.33										
RC		8.15	5.88	7.72	4.16								
RM1				12.66	11.98								
RP3				6.69	7.77								
RI2				7.06	3.53								
RI1				5.71	3.09								
Mid-circumference-left							62						
Max. diam. mid-shaft-left							20.37						
Min. diam. mid-shaft-left							15.46						
Least circum. (distal to deltoid)-left							56						
Radial head diam-right								22.21					
Sagittal diam. mid-shaft (A-P)-right								11.48					
Transverse diam. mid-shaft (M-L) right								12.7					
Min.circum. (nr. distal end)-left									33				
Subtrochanteric (A-P) diam. right										21.57			
Subtrochanteric (A-P) diam. left										20.35			
Subtrochanteric (trans.) diam. right										30.32			
Subtrochanteric (trans.) diam. left										31.73			
Mid-shaft (A-P) diam. -right										25.66			
Mid-shaft (trans.) diam. -right										24.87			
Circum. mid-shaft-right										81			
Mid-shaft (A-P) -right											29.98		
Mid-shaft (A-P) -left											27.36		
Mid-shaft (trans.) -right											18.19		
Mid-shaft (trans.) -left											18.68		
Max.diam. at mid-shaft -right												13.29	
Max. diam. at mid-shaft-left												13.33	
Height-right													37.87
Width-right													40.48
Thickness-right													20.4
Burial 22: Measurement/Element	Mastoids	Maxilla M-D	Maxilla B-L	Mandible M-D	Mandible B-L	Clavicle	Humerus	Radius	Ulna	Femur	Tibia	Fibula	Patella
Breadth-right	22.74												
Breadth-left	23.68												
Length-right	31.2												
Length-left	32.2												
LC		8.12	7.92										
LI2		6.52	5.56										
RM2				11.5	10.1								
RP4				7.37	8.52								
RP3				6.6	7.7								
RI2				3.6	6.24								
LM3				11.98	10.43								
LM2				12.06	10.68								
LM1				11.78	10.65								
LP4				7.75	8.84								
Sag. diam. mid-shaft (A-P)-left						16.45							
Vertical (cranial-caudal) diam. (mid.)-left						12.19							
Circumference at mid-shaft-left						46							
Mid-circumference-right							70						
Max. diam. mid-shaft-right							24.58						
Min. diam. mid-shaft-right							20.9						
Least circum. (distal to deltoid)-right							65						
Max.diam. A-P-right									15.24				
Trans. diam. (perpend. to A-P)-right									14.7				
Min. circum. (nr. distal end)-right									36				
Subtrochanteric (A-P) diam.-right										24.39			
Subtrochanteric (trans.) diam.-right										35.38			
Mid-shaft (A-P) diam.-right										29.84			
Mid-shaft (trans.) diam.-right										26.16			
Circum. mid-shaft-right										88			

**APPENDIX D**  
**RADIOCARBON ANALYSIS**



# BETA ANALYTIC INC.

## RADIOCARBON DATING SERVICES

Dr. MURRY A. TAMERS  
Mr. DARDEN G. HOOD  
Directors

RONALD E. HATFIELD  
Laboratory Manager

CHRISTOPHER PATRICK  
TERESA A. ZILKO-MILLER  
Associate Managers

September 19, 1997

Mr. Jack Meyer  
Sonoma State University  
Anthropological Studies Center  
1801 East Cotati  
Rohnert Park, CA 94928

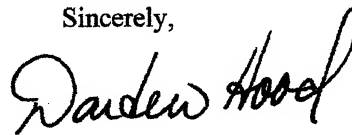
Dear Mr. Meyer:

Please find enclosed the radiocarbon dating results for one charcoal sample (LVAP 63) which was submitted on August 19. We isolated a small amount of charcoal (about 22 mg) from 20 grams of submitted sediment. The sample was analyzed using AMS. Pretreatment, C14 content measurement and age calculation went normally. The quoted errors represent 1 sigma statistics. Since these errors cannot include uncertainties outside of those which can be quantified during measurement, it is best to consider them as minimum quotes.

Literature discussing the generalities of analysis and calendar calibration are enclosed. The "Analytical Procedures and Final Report" discussion should answer most questions about the report and results. If you have any specific questions, please do not hesitate to contact us.

Our invoice is enclosed. Please, immediately give it to the appropriate office for prompt payment or send VISA charge authorization. Thank you.

Sincerely,



4985 S.W. 74 COURT, MIAMI, FL 33155 U.S.A.  
TELEPHONE: 305-667-5167 / FAX: 305-663-0964 / INTERNET: beta@radiocarbon.com  
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# BETA ANALYTIC INC.

DR. M.A. TAMERS and MR. D.G. HOOD

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## REPORT OF RADIOCARBON DATING ANALYSES

FOR: Mr. Jack Meyer

DATE RECEIVED: August 19, 1997

Sonoma State University

DATE REPORTED: September 19, 1997

Sample Data	Measured C14 Age	C13/C12 Ratio	Conventional C14 Age (*)
Beta-108327	7840 +/- 50 BP	-27.4 o/oo	7800 +/- 50 BP

SAMPLE #: LVAP 63

ANALYSIS: AMS(Oxford)

MATERIAL/PRETREATMENT:(charred material): acid/alkali/acid

NOTE: It is important to read the calendar calibration information and to use the calendar calibrated results (reported separately) when interpreting these results in AD/BC terms.

Dates are reported as RCYBP (radiocarbon years before present, "present" = 1950A.D.). By International convention, the modern reference standard was 95% of the C14 content of the National Bureau of Standards' Oxalic Acid & calculated using the Libby C14 half life (5568 years). Quoted errors represent 1 standard deviation statistics (68% probability) & are based on combined measurements of the sample, background, and modern reference standards.

Measured C13/C12 ratios were calculated relative to the PDB-1 international standard and the RCYBP ages were normalized to -25 per mil. If the ratio and age are accompanied by an (\*), then the C13/C12 value was estimated, based on values typical of the material type. The quoted results are NOT calibrated to calendar years. Calibration to calendar years should be calculated using the Conventional C14 age.

## CALIBRATION OF RADIOCARBON AGE TO CALENDAR YEARS

(Variables: C13/C12=-27.4; lab mult.=1)

Laboratory Number: Beta-108327

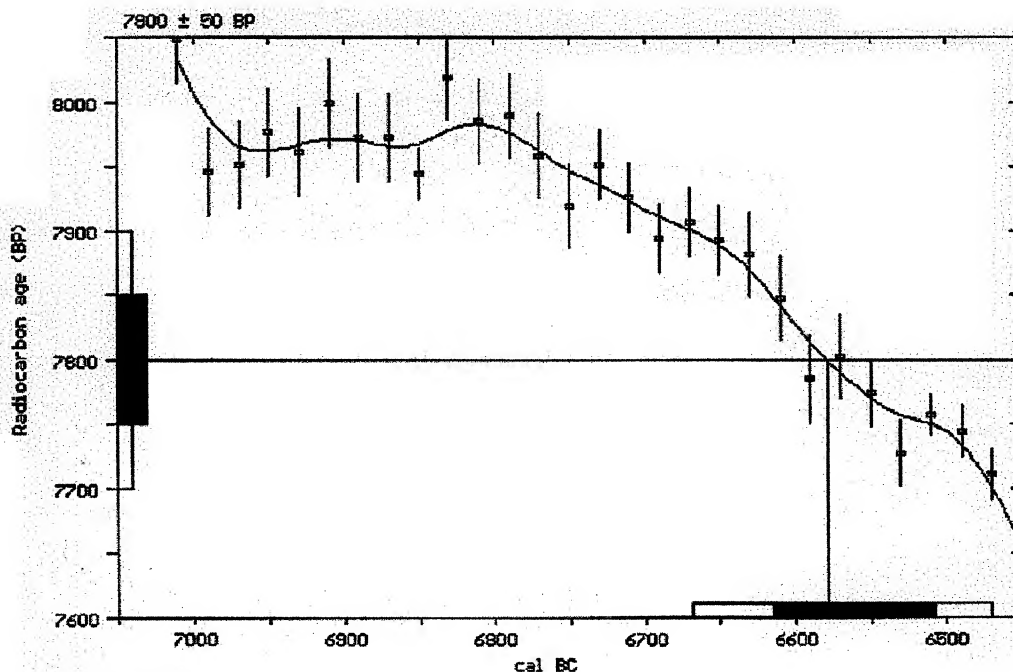
Conventional radiocarbon age:  $7800 \pm 50$  BP

Calibrated results:  
(2 sigma, 95% probability) cal BC 6670 to 6470

Intercept data:

Intercept of radiocarbon age  
with calibration curve: cal BC 6580

1 sigma calibrated results:  
(68% probability) cal BC 6615 to 6510



### References:

- Pretoria Calibration Curve for Short Lived Samples*  
Vogel, J. C., Fuls, A., Visser, E. and Becker, B., 1993, *Radiocarbon* 35(1), p73-86
- A Simplified Approach to Calibrating C14 Dates*  
Talma, A. S. and Vogel, J. C., 1993, *Radiocarbon* 35(2), p317-322
- Calibration - 1993*  
Stuiver, M., Long, A., Kra, R. S. and Devine, J. M., 1993, *Radiocarbon* 35(1)

## Beta Analytic Radiocarbon Dating Laboratory

4985 S.W. 74th Court, Miami, Florida 33155 ■ Tel: (305)667-5167 ■ Fax: (305)663-0964 ■ E-mail: [beta@radiocarbon.com](mailto:beta@radiocarbon.com)

**UNIVERSITY OF WASHINGTON  
QUATERNARY ISOTOPE LAB  
RADIOCARBON CALIBRATION PROGRAM REV 3.0.3c  
MAC TEST VERSION #10**

Stuiver, M. and Reimer, P.J., 1993, Radiocarbon, 35, p. 215-230.

Calibration file(s): INTCAL93.14C

**Laboratory #:** Beta-108327

**Sample #:** LVAP 63

**Description:** Burial 21, CA-CCO-637, Los Vaqueros Area, Contra Costa County, CA.

**Radiocarbon Age BP** 7800 +/- 50

**Calibrated age(s)** cal BC 6595, **6573**, 6569  
cal BP 8544, **8522**, 8518

Reference(s) (Pearson et al., 1993 and Linick et al., 1986)

**cal AD/BC (cal BP) age ranges obtained from intercepts (Method A):**

one Sigma\*\* cal BC 6617 - 6537 (8567 - 8487)  
cal BC 6517 - 6492 (8467 - 8442)  
two Sigma\*\* cal BC 6702 - 6466 (8652 - 8416)

**Summary of above:**

minimum of cal age ranges (cal ages) maximum of cal age ranges:

1 sigma cal BC 6617 (6595, 6573, 6569) 6492  
cal BP 8566 (8544, 8522, 8518) 8441  
2 sigma cal BC 6702 (6595, 6573, 6569) 6466  
cal BP 8651 (8544, 8522, 8518) 8415

**cal AD/BC & cal BP age ranges from probability distribution (Method B):**

<u>% area enclosed</u>	<u>cal BC (cal BP) age ranges</u>	<u>relative contribution to probabilities</u>
68.3 (1 sigma)	cal BC 6618 - 6535 (8568 - 8485) 6522 - 6487 (8472 - 8437)	.75 .25
95.4 (2 sigma)	cal BC 6755 - 6746 (8705 - 8696) 6709 - 6463 (8659 - 8413)	.01 .99

**References for datasets used:**

Bidecadal weighted average of data from:

Pearson, GW, Becker, B, and Qua, F, 1993, Radiocarbon, 35, 93-104.

Linick, TW, Long, A, Damon, PE and Ferguson, CW, 1986, Radiocarbon, 28, 943-953.

**Comments:**

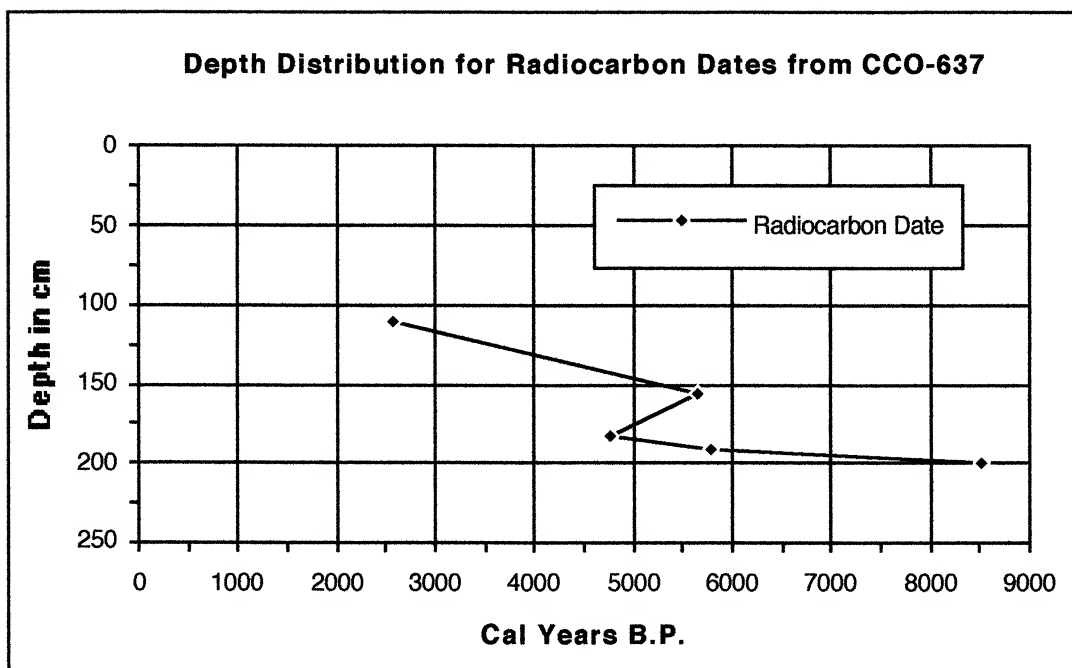
† This standard deviation (error) includes a lab error multiplier.

\*\* 1 sigma = square root of (sample std. dev.^2+ curve std. dev.^2) 2 sigma = 2 x square root of (sample std. dev.^2+ curve std. dev.^2)

[ ] = calibrated with linear extension to calibration curve 0\* represents a "negative" age BP 1955\* denotes influence of bomb C-14.

For cal yrs between 5500-5190 BC an offset of 25 years is possible.

**NOTE:** Cal ages and ranges are rounded to the nearest year which may be too precise in many instances. Users are advised to round results to the nearest 10 yr. for samples with standard deviation in the radiocarbon age greater than 50 yr.



**APPENDIX E**  
**REBURIAL SITE RECORDS**

<b>State of California — The Resources Agency</b> <b>DEPARTMENT OF PARKS AND RECREATION</b> <b>PRIMARY RECORD</b>		<b>Primary#</b> P-07-000532 <b>HRI#</b> _____ <b>Trinomial</b> CA-CCO-_____ <b>NRHPStatusCode</b> _____
<b>OtherListings</b> <b>Review Code</b> _____	<b>Reviewer</b> _____	<b>Date</b> _____

Page 1 of 3

\*Resource Name or #: Reburial Site

**P1. Other Identifier:**

**\*P2. Location:** ☒ Not for Publication ☐ Unrestricted

**\*a. County:** Contra Costa and

**\*b. USGS 7.5' Quad:** Byron Hot Springs **Date:** 1953 (photorevised 1968) **T 1S; R 2E; Canada de Los Vaqueros; M.D. B.M.**

**c. Address:**

**City:**

**Zip:**

**d. UTM: Zone:** 10; 611000760 mE/ 4186800 mN

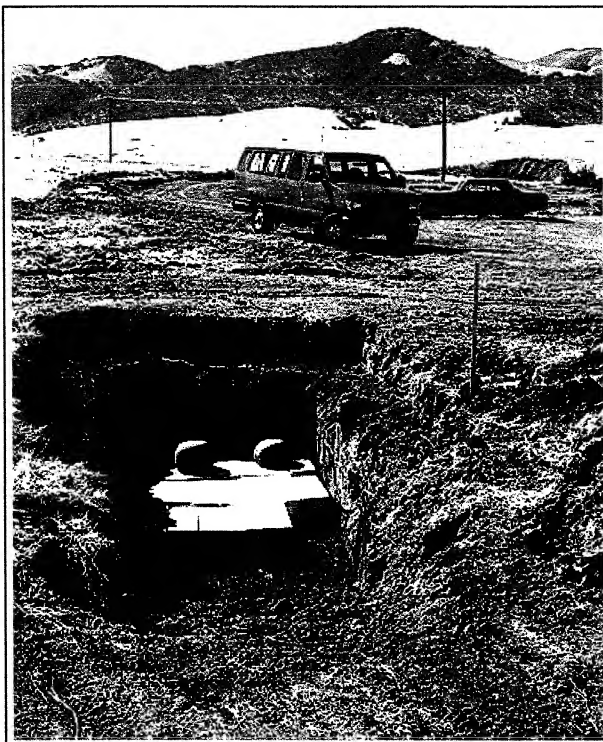
**e. Other Locational Data:** The site lies in the upper Kellogg Creek drainage at an elevation within the Los Vaqueros Reservoir that will remain underwater. It is located about 5.9 miles WSW of the town of Byron, California, about 3.5 miles north of the Alameda and Contra Costa County line, and about 0.15 miles east of the former Vasco Road. The site lies just southeast of a curve in the driveway for the former Ordway Ranch complex (CA-CCO-470H).

**\*P3a. Description:** The site consists of 19 wooden boxes that contain the remains of at least 205 prehistoric Native Americans and associated artifacts (including flaked stone, groundstone, projectile points, shell beads and ornaments) recovered during archaeological investigations for the Los Vaqueros Project (Meyer and Rosenthal 1997). The remains include 3 from CA-CCO-458/H, 1 from CA-CCO-459, 7 from CA-CCO-631, 25 from CA-CCO-637, and 169 from CA-CCO-696. Each box contains the remains of about 10 individuals and the associated artifacts. Two rows of 7 boxes and 1 row of 5 boxes were placed at the bottom of a mechanically excavated 8 by 16 foot trench, at a depth of about 5 feet below the present ground surface. In addition, two sandstone bowl mortars (which were too large to fit in the boxes) were placed on the box that contained the remains of the individual (Burial 27 and Burial 57 from CCO-696) with which they were found (see Photo P5a). Three 1997 United States of America 1 cent coins were placed in the trench to mark the year of the reburial. The trench was filled with earth, covered with a 1-foot-thick layer of angular sandstone rocks that was then covered with a thin layer of earth. The site is not marked by any monument except for the overlying mound of rocks and earth.

**\*P3b. Resource Attributes:** AP9 Burials; AP16 Redeposit

**\*P4. Resources Present:** Building Structure Object ☒ Site District Element of District Other:

P5a. Photo or Drawing (Photo required for buildings, structure, and objects.)



**P5b. Description of Photo:**  
 (View, date, accession #)  
 Southwest, 11/01/97, #R1/F17  
 Job# 51256-5/95

**\*P6. Date Constructed/Age and Sources:**  
 Historic ☐  
 Prehistoric ☒ Both

Reburial of prehistoric remains

**\*P7. Owner and Address:**  
 Contra Costa Water District  
 1231 Concord Avenue  
 Concord, CA 94524

**\*P8. Recorded by:**  
 Jack Meyer and Jeffrey Rosenthal  
 Anthropological Studies Center  
 Sonoma State University  
 Rohnert Park, CA 94928

**\*P9. Date Recorded:** 11/01/97

**\*P10. Survey Type:** NA

**\*P11. Report Citation:** *Archaeological and Geoarchaeological Investigations at Eight Prehistoric Sites in the Los Vaqueros Reservoir Area, Contra Costa County, California.* Los Vaqueros Final Report #7. Report prepared for the Contra Costa Water District. Anthropological Studies Center, Sonoma State University, Rohnert Park, California. By Jack Meyer and Jeffrey S. Rosenthal (1997).

**\*Attachments:** NONE ☒ Location Map ☒ Sketch Map ☐ Continuation Sheet ☐ Building, Structure, and Object Record  
☐ Archaeological Record ☐ District Record ☐ Linear Feature Record ☐ Milling Station Record ☐ Rock Art Record  
☐ Artifact Record ☐ Photograph Record ☐ Other:

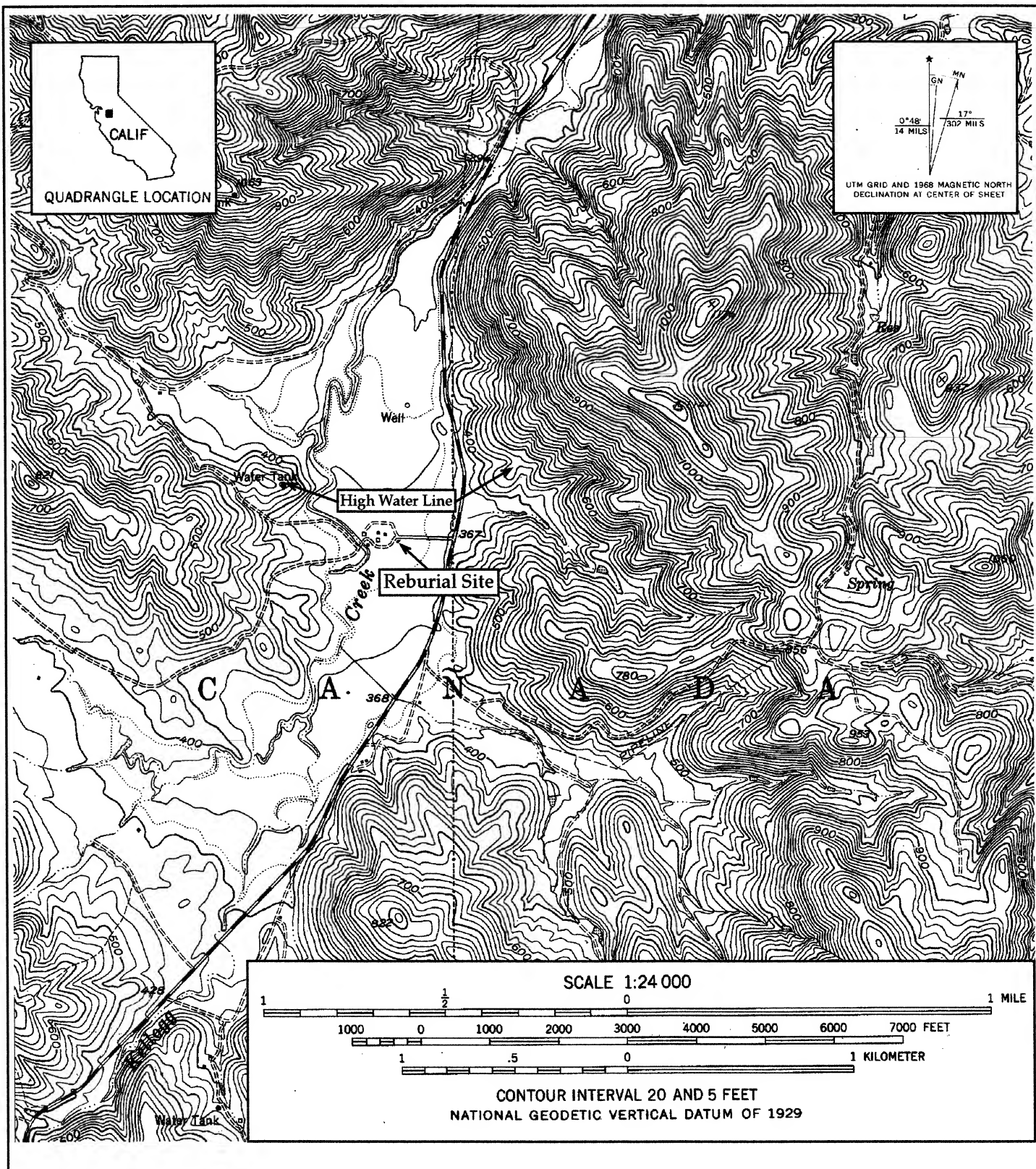
## LOCATION MAP

Page 2 of 3

\*Resource Name or # (Assigned by recorder) Reburial Site

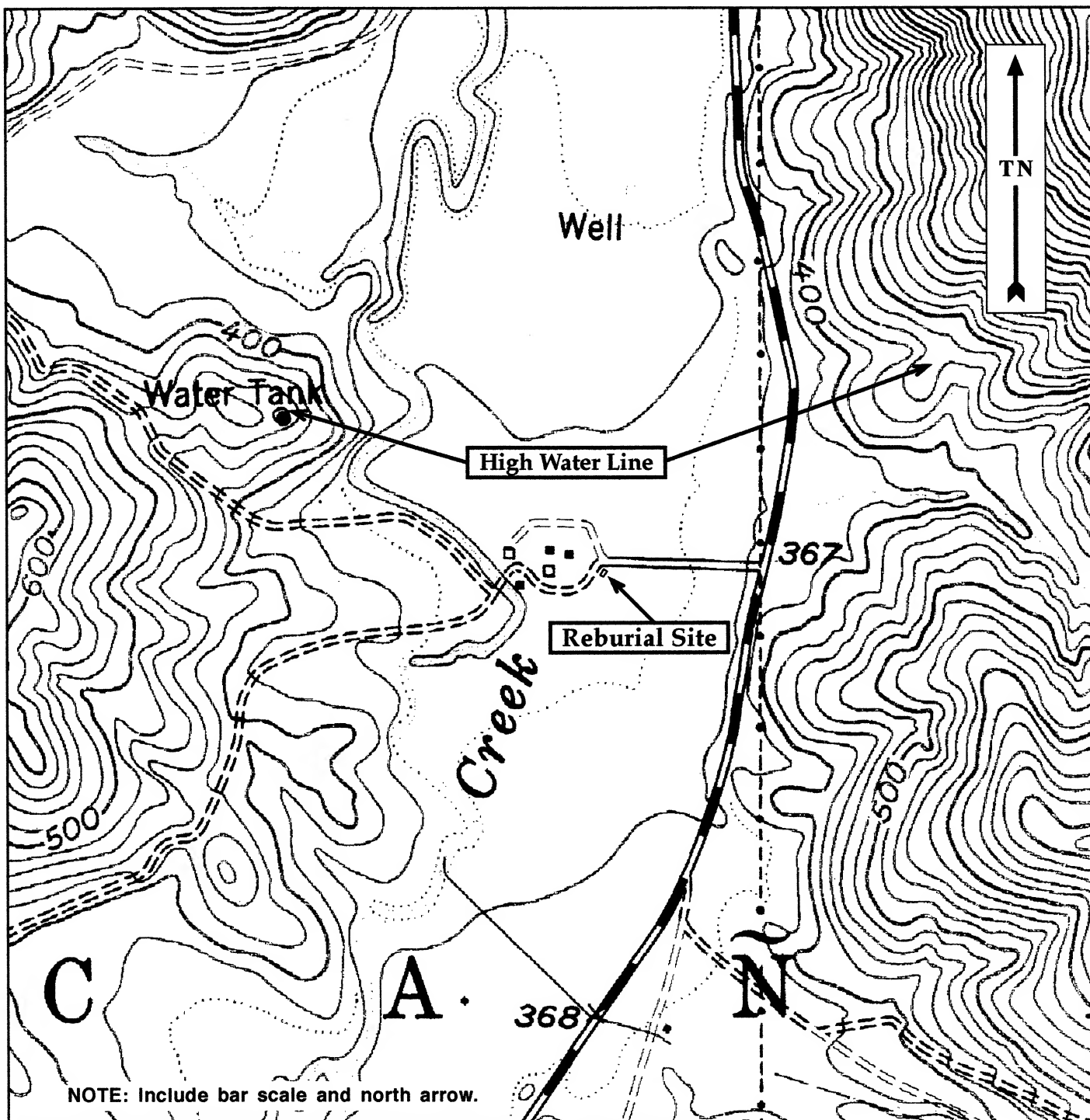
\*Map Name: USGS Byron Hot Springs, Calif., 7.5' Quadrangle Scale: 1:24,000

\*Date of Map: 1953 (1968)





**SKETCH MAP**



Base Map: 1953 (1968) USGS Byron Hot Springs, Calif., 7.5' Quadrangle Scale: 1:24,000 (enlarged)

